University of the State of New York Bulletin

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Smithsonian Institution
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National Museum

New York State Museum

JOHN M. CLARKE, Director

Museum Bulletin 177

ELEVENTH REPORT OF THE DIRECTOR OF THE STATE MUSEUM AND SCIENCE DEPARTMENT

INCLUDING THE SIXTY-EIGHTH REPORT OF THE STATE MUSEUM, THE THIRTY-FOURTH REPORT OF THE STATE GEOLOGIST, AND THE REPORT OF THE STATE PALEONTOLOGIST FOR 1914

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ALBANY

THE UNIVERSITY OF THE STATE OF NEW YORK

1915

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THE UNIVERSITY OF THE STATE OF NEW YORK

(September 1, 1915)

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With years when terms expire

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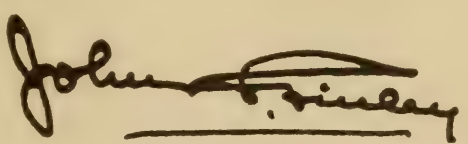
The University of the State of New York
Department of Science, March 29, 1915

John H. Finley
President of the University

IR: I have the honor to transmit herewith my annual report Director of the State Museum for the fiscal year ending Septem- 30, 1914, and to recommend it for publication as a Museum etin.

Very respectfully
JOHN M. CLARKE
Director

proved for publication this 31st day of March 1915



President of the University

University of the State of New York Bulletin

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New York State Museum

John M. Clarke, Director

Smithsonian Institution
Oct 22 1915

Museum Bulletin 177

ELEVENTH REPORT OF THE DIRECTOR OF THE STATE MUSEUM AND SCIENCE DEPARTMENT

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INTRODUCTION

This report covers all divisions of the scientific research and Museum work under the charge of the Regents of the University and concerns the progress made therein during the fiscal year 1913–14. It constitutes the 68th consecutive annual report of the State Museum, the 34th annual report of the State Geologist (consecutive since 1881) and the report of the State Paleontologist for 1914. It is introductory to all memoirs, bulletins and other publications issued from this Department during the year named.

The committee of the Board of Regents having supervision of the affairs of this Department are the Honorables: Charles B. Alexander M.A. LL.B. LL.D. Litt.D., Tuxedo; Francis M. Carpenter, Mount Kisco; Walter Guest Kellogg B.A., Ogdensburg.

The subjects presented in this report are considered under the following chapters:

I Condition of the Science Museum
II Miscellaneous Museum Affairs
III The Preservation of Natural Monuments
IV Report on the Geological Survey
V Report of the State Botanist

VI Report of the State Entomologist
VII Report on the Division of Zoology
VIII Report on the Division of Archeology and Ethnology
IX Report on the Publications of the Department for the Year
X Staff of the Department
XI Accessions to the Collections
XII Scientific papers in this bulletin
XIII Appendixes (to be continued in subsequent volumes)

I

CONDITION OF THE SCIENTIFIC MUSEUM

In the report of the preceding year, attention was directed to the progress made in the case equipment of the Museum and the installation of the exhibits therein. The first contract for Museum cases was entered into with George W. Cobb, jr, and under this contract 384 cases of 28 different types were called for and delivered. Some extended account with illustrations was given last year of these various types of Museum cases, it being thought that the information would be of service to other museums. As a matter of record it may be here put down that the workmanship on these cases was of a high grade and is proving not only substantial but satisfactory in all except a few minor particulars.

The installation has now proceeded to practically the complete equipment of all the cases that have been installed in the main hall, Mineralogy — Geology — Paleontology, there being in this hall only a few remaining where the exhibits have yet to be completed. In the Zoology Hall a number of cases have yet to be filled, especially those which were designed to hold the entomological collections. The designs of the State Architect for these cases were never complete and upon their receipt it was necessary to add new construction which required 450 joined and veneered panels which it proved very difficult to get satisfactorily made. The work upon these entomological cases is now approaching conclusion and installation will presently begin.

It became evident a year ago that the case equipment for the paleontology hall was inadequate and a contract was made with the Ely J. Rieser Company of New York for the construction of 37 additional cases of a new type designated as "AA," which have now been delivered and are in the process of equipment. These cases are of small size, with a straight back and desk front, designed to be placed against the walls, and have them arranged about the long walls of the paleontology hall.

The installation of the collections in archeology was for a long time obstructed by pending plans for the execution of the Iroquois group cases, and in the uncertainty as to the final form of these and their date of completion no progress could be made in this division of the Museum exhibits. The exhibits for this division have been assigned to the eastern and western mezzanine floors, an area which, except for the intervention of the rotunda, has the

full length of the building, 570 feet, and a width of about 50 feet. In the planning of the Museum, the easternmost of these mezzanine halls was assigned to botany, but the imperative demands of archeology have made it necessary to allot this space to the archeology division. A large part of the archeology cases which had been placed provisionally in the west mezzanine have been transferred to the east mezzanine and added to the equipment of the cases there and so arranged as to effect an orderly succession of the entire assemblage of cases. In these most of the archeological material, including the greater part of the valuable recent acquisitions, has been, in large measure, installed and the work is now in progress.

After many long and troublesome delays, a contract has finally been entered into for the construction of the Iroquois group cases and for the necessary electric wiring in connection therewith. This contract is in the hands of William Plass & Bro. of New York, and the work is about to begin. This order calls for the construction of 6 very large cases of concrete, steel and glass, to go in the western mezzanine, and until the work is done the Museum will not be in proper condition for opening to the public. It is quite likely that the quality of construction called for in these cases, to be carried out in the Museum halls, will prove a considerable embarrassment to the orderliness and cleanliness of the collections already installed. This condition, however, has to be met and, once passed, it may be hoped that the Museum will settle down to a permanent state of orderly arrangement.

Special designs for the Museum collections. The installation of the collections has called not only for the elaboration and effective display of actual natural materials, but has exercised the skill and ingenuity of the staff in the production of designs and restorations which would help to illuminate these collections. Perhaps it is true that the collection of invertebrate fossils has made the most exacting demands of this kind, because of the difficulties with which the comprehension of the fossil object by the ordinary observer is attended. It has been the purpose, so far as is reasonable and practicable, to make the structure of the extinct forms of life preserved in the rocks better intelligible by the help of such restorations and other forms of illustration. Attention was called in my last report to a number of these objects, most of which have been produced by the members of the staff, and occasion may here be taken to enumerate the restorations and models of various kinds recently installed for the purpose of serving the end indicated:

Model of down-draught brick kiln
Made by R. W. Jones

Model of oil derrick, shaft buildings and drill
The overground work by Donald Hansett and Raymond Sisson, boys of the vocational class in the Wellsville High School; underground work by N. T. Clarke

Relief model of Mormon Hill and the surrounding country, in the vicinity of Palmyra; an illustration of glacial drumlins

Model showing by a series of well sections, the varying depth of the salt-bearing strata in central and western New York
Made by R. W. Jones

Restoration of Archaeosigillaria, one of the earliest known trees
By Henri Marchand

Life-size restoration of the Giant Beaver (Castoroides ohioensis)
By Henri Marchand

One-eighth natural size reproduction of the glacial pothole in which the Cohoes mastodon was found
By Henri Marchand

The puma
Modeled and cast by Henri Marchand

Life-size restoration of the Devonic fish, Bothriolepis
By Henri Marchand

Additional restorations of Devonic fishes by Jaekel, Hussakof and others

Eusarcus habitat group; submarine view of these extinct scorpions
By Henri Marchand

Panel restorations in life dimensions of the extinct scorpions Pterygotus, Eusarcus and Stylonurus
By Henri Marchand

Restorations of the development of the extinct scorpions Hughmilleria, Pterygotus, Stylonurus and Eurypterus
By R. Ruedemann

Development series of the extinct cephalopod Manticoceras
By R. Ruedemann

Restorations of the cephalopods Gyroceras, Trochoceras, Piloceras, Manticoceras, Endoceras
By R. Ruedemann

Life-size restoration of Orthoceras
By N. T. Clarke

Full-size restorations of the largest of the known trilobites, representing the genera Terataspis, Homalonotus, Dalmanites
By Henri Marchand

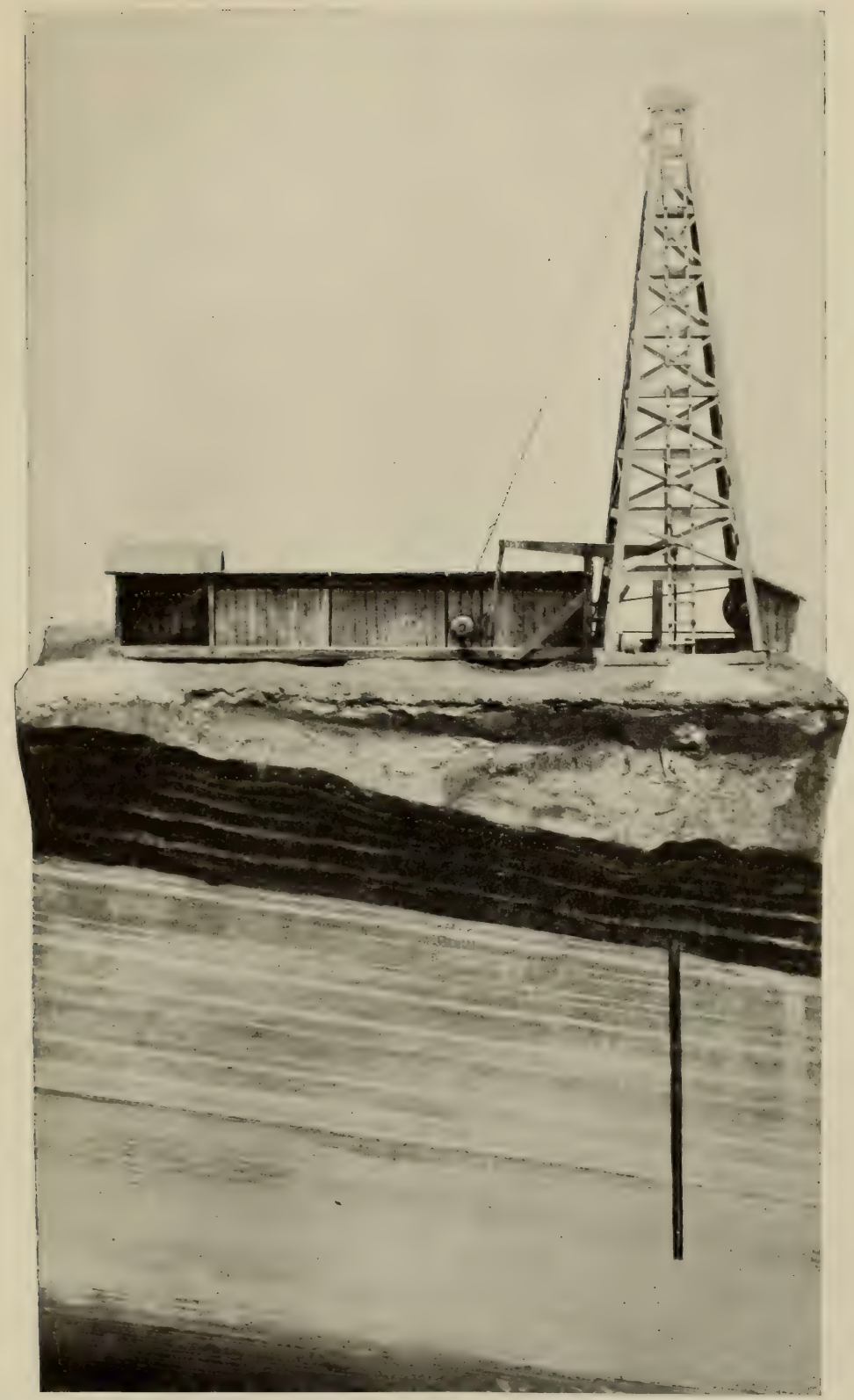
Restoration of the phyllocarid crustacean Mesothyra
By Henri Marchand

Life-size panel restorations of dorsal and ventral surface of Hughmilleria and Eurypterus

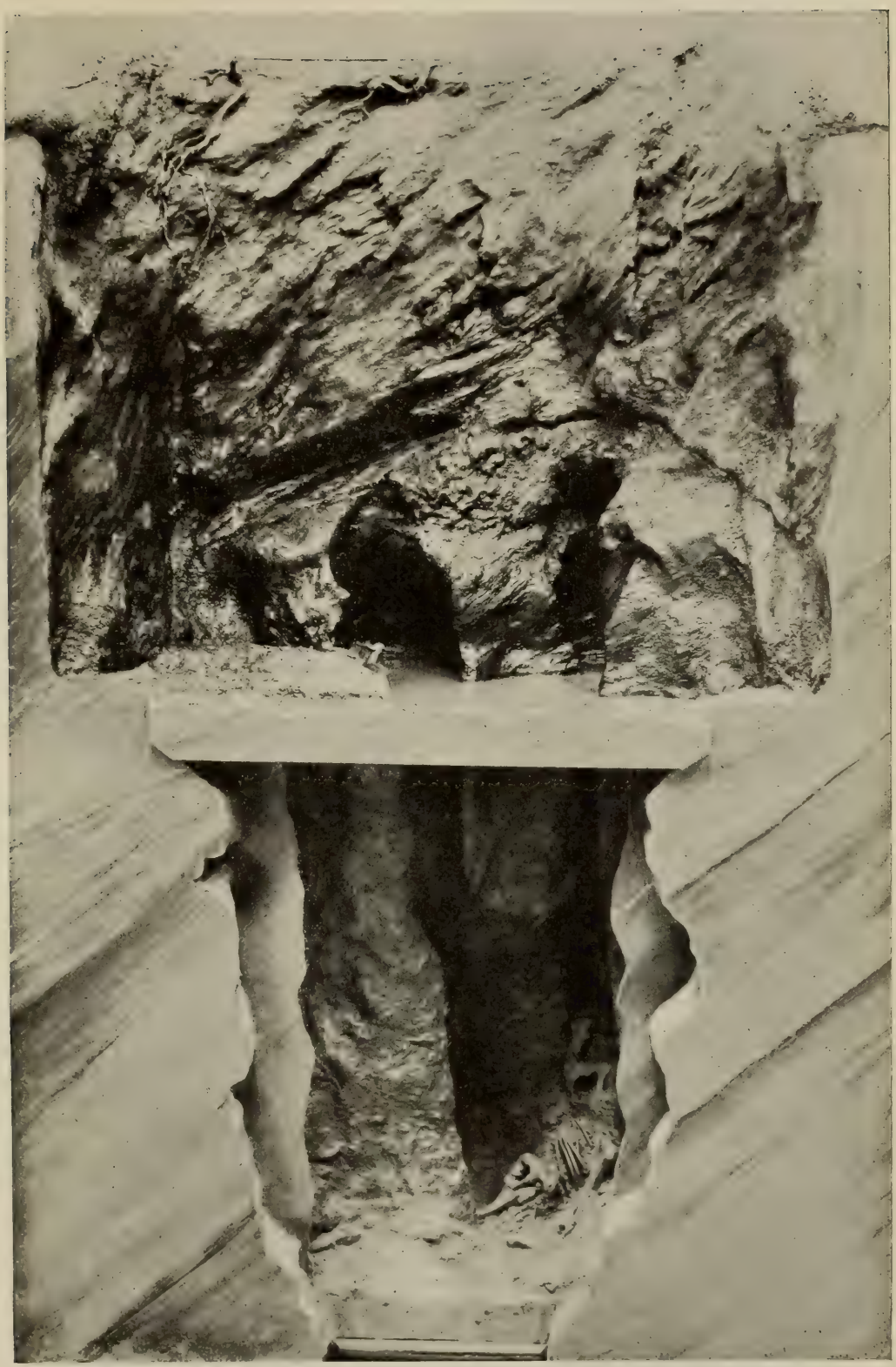
By G. S. Barkentin

General Museum matters. For a year past the funds of the Museum have been too low to hasten the progress of the work. It has been necessary to fall back practically to the appropriation which for years has been made without change for the maintenance of the entire work of the Science Division, regardless of the added cost and responsibility of Museum equipment. Should anyone be disposed to intimate that the equipment of the Museum was not advancing with expected celerity, here lies the cause.

The present quarters of the Museum are in many ways attractive and capacious but are far from presenting ideal conditions for a museum of any kind. The space available for the display of the scientific collections is wholly inadequate and compels the contraction of these collections, even though they are planned to represent only the natural resources of New York State, to much less, both in quantity and quality, than they ought to be and much less than the actual possessions of the Department would permit. This very fact has required the most careful and serious consideration in the selection of the superior material only for exhibition purposes, while very much that is good and instructive and equally important to have accessible, remains and must continue to remain out of sight on account of this lack of adequate room. This is a serious obstacle to the development and future growth of the Museum, and there is not much satisfaction in looking forward to the time in the immediate future when it will be necessary to regard the Museum as finished, for such a condition implies stagnation and will fail to measure up both with the public interest and the demands of the science, were it not that we may anticipate with reasonable hope the time when the science museum, together with the other museums which, though not yet realized, are contemplated in the organic law governing the State Museum, will be installed in its own building, free of entanglements with interests not wholly germane to its own.



Model of an oil-well and derrick



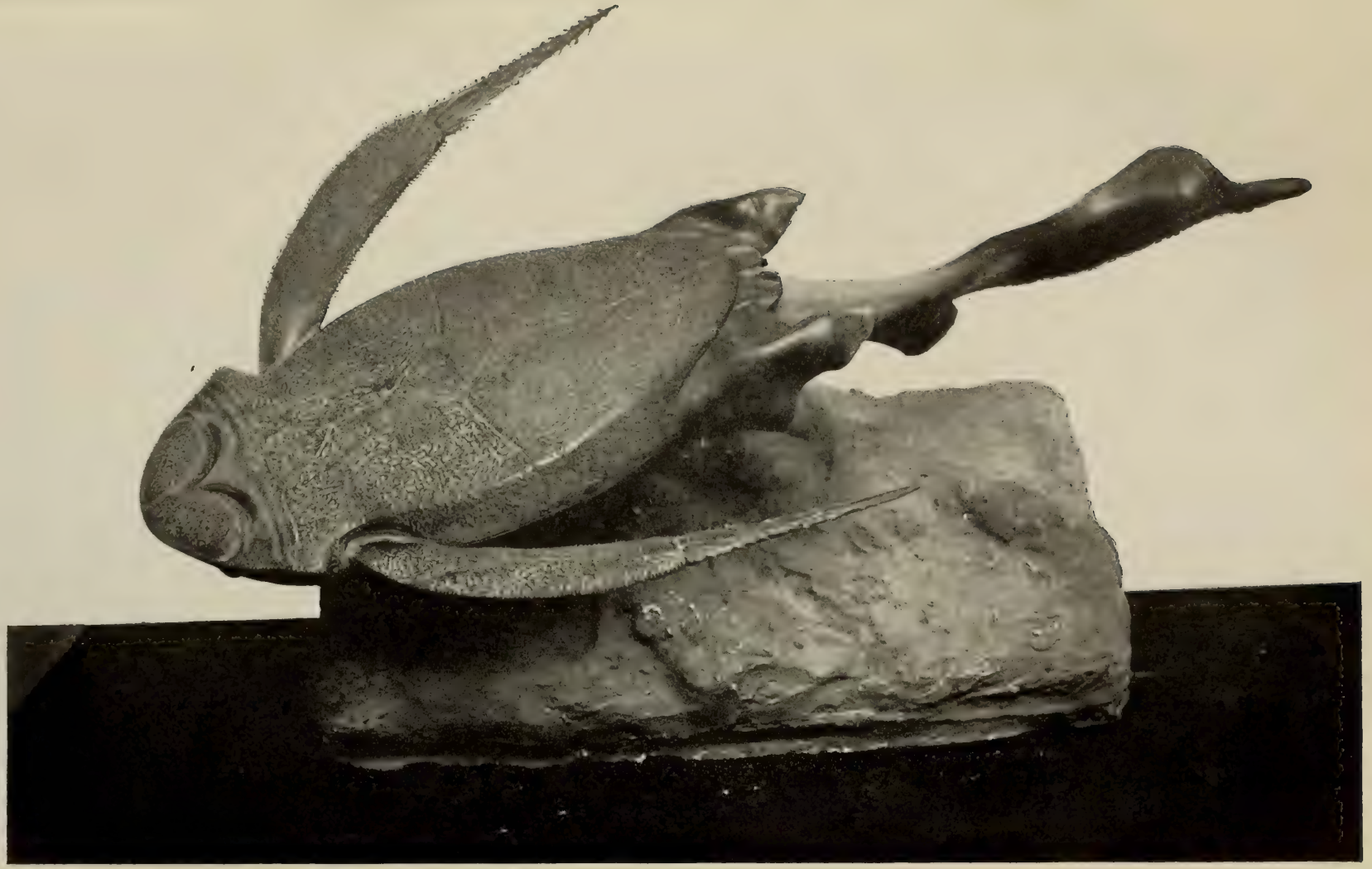
Restoration of the great glacial pothole in which the Cohoes mastodon was found. One-eighth natural size
By Henri Marchand

THE PUMA

By Henri Marchand

A Devonic fish (Bothriolepis canadensis as restored by Patten)
Modeled by Henri Marchand

Profile of the same model



Ventral surface of Bothriolepis, by Marchand

Restorations of a small Devonic fish (Cephalaspis Patten) by Marchand

II

MISCELLANEOUS MUSEUM AFFAIRS

The functions of the State Museum and the codification of the Museum law. It has been often pointed out in the reports of this Department that the function of the Museum, as indicated by the law establishing it as a department of the University, is very broad in its character and provides for the existence at the center of government of a great central museum which shall cover the entire field of museum activities and service. It happens that the State has not as yet developed any part of this central museum except the museum of science. The efforts of the Director during a number of years past to initiate a museum of history are a matter of record. With equal force the law provides for a museum of art, of agriculture and the industrial arts and of education. Furthermore, while the essential organizing law of the museum is brief and very broad in its scope, the definition of the educational functions of the State Museum is somewhat extended as it now stands in the Education Law. The Education Law defines the relations of the Museum to a system of free public museums; it provides for and defines the procedure in the establishment of a system of free public museums; it makes provisions for grants of money to such museums, subject to the approval of the Legislature, and particularizes with great definiteness the safe-guarding of the property of such museums. Neither the State Museum nor its affiliation with free public museums has been developed along the lines indicated by the outstanding Education Law. This may be due to several considerations, among them the fact that the Museum has but recently come into visual evidence as a factor in the educational service, notwithstanding its long history as a creator of new knowledge; and the further fact that this law relating to the scope and functions of the Museum respecting its affiliation with free and public museums and with respect further to the organization and development of such free museums has been hidden away in the statute book under other designations. All the outstanding laws pertaining to the functions of the institution have been assembled with a view to their codification, and this body of law, which may be properly termed the "Museum law," may well be formally incorporated as a special chapter of the Education Law. There are certain outstanding functions which the Museum actually performs but which it does not execute as a department of the University, such as the

work of the Board of Geographic Names, which was established under an executive law, and it seems a very proper procedure that this work should be formally taken over by the University.

It may be said that the law relating to the functions of the Museum provides in every way adequately for the highest development of the museum idea as a part of the education service. To carry out this idea and attain the end actually contemplated in the enactment of this law is the most worthy end which the Department in its relations to the University and its relations to the people of the State, can hold before it.

Grants to public museums. The right exists in law to make grants of money to public museums on the same basis as grants of such public moneys are made to the libraries of the State. It is believed that a number of struggling local public museums in the communities of the State would be encouraged to much greater usefulness and activity if such recognition by the State could be assured to them in accordance with the evident intent of the law.

Traveling scientific collections. The possibility of putting into circulation traveling scientific collections which might serve the schools, school centers and other educational agencies of the State, has been brought forward for consideration and received careful thought.

The proposition is not a new one, nor is it outside the experience of the State Museum. The situation in New York is somewhat different in this regard than in other states where such movable scientific collections are in use. Here the central museum of the State is distinctively a State Museum and it is not within its scope to enter into competition with what may be called "world museums."

To be effective, it is evident that the circulation of scientific collections must be among the students of natural science and principally of our schools. Twenty-five years ago the curriculums of the schools allowed opportunity for the study of geology wherein would lie a strong appeal of such scientific collections. Today this science is not taught in the secondary schools. It is probably correct to say that in the adjustment of courses for the lower schools the vast preponderance of the pupils of this generation is deprived of the opportunity to acquire the knowledge that was freely at the command of their fathers and mothers.

Many years ago when the State Museum was accumulating large quantities of geological specimens for the perfection of the Paleontology of New York, it was the wish and order of the Regents

that the excess of specimens then acquired be distributed to certain schools of the State. A list of about fifty schools, made up largely upon the application from the schools themselves, was approved by the Board and collections were sent to these from time to time, all duly labeled and explained. Today only occasional traces of these collections are to be found, most of them having been thrown together or thrown away in careless disregard. The effort was a fruitless one. It resulted in little good to the schools and in considerable damage to the State Museum until by a formal vote of the Regents the sending out of collections to the schools was discontinued.

In the present status of natural science in our lower and secondary schools there seems little practical objective in the somewhat costly enterprise of circulating general traveling collections of scientific objects. We are not aware that in any of the older and more experienced countries of the globe efforts are made to disseminate knowledge in this way even where the sciences are still honored as fundamental factors of an elementary education. Experience has taught them that the youth who would know geology or botany or zoology or whatever science, must be encouraged to make his own observations and his own collections and not be overwhelmed by a burden of illustrations from all parts of the world which are beyond his powers of assimilation.

Much more efficient, as a factor in science training, would be the encouragement of every school in the establishment and maintenance of a *school museum,* the museum to be subject to inspection and supervision by the Museum Department. But even this would be effective only when the teacher of science in the schools is made to inspire an interest in the upbuilding of such museums.

Birds of New York. During the past year volume 2 of Birds of New York, which constitutes State Museum Memoir 12, was published and distributed. These two sumptuous quarto volumes have aroused a widespread interest and the demand for them has been very large, even though they have been for the most part restricted to sale. On account of the small edition of the work and its large size, made necessary by the lengthy descriptive accounts of every species of bird occurring in the State, and the high price attached to it, the work in this form has not reached the public so fully as desired, and it has been thought best to widen the usefulness of this publication by issuing more freely a reprint of the 106 color plates. As these plates carry the names of the birds, it is thought that they will serve an effective purpose, even without any

accompanying descriptive matter. There are now being issued 15,000 copies of these plates, printed on an inexpensive paper, without serious loss of color effect, and bound in cloth portfolios. It is the purpose to place one of these books in every school in the State, excepting such of the high schools as have already received the larger volumes for their libraries. It was decided to hold volumes 1 and 2 of Memoir 12 for sale at $6. This cheaper edition of the plates can be sold at 60 cents, and those remaining, after the distribution to the schools, will be so held for sale.

The State mining exhibit at the Panama-Pacific Exposition. A collective exhibit of the mineral resources of the State and their industrial applications has been prepared for display at the Panama-Pacific Exposition which is to be held in 1915 in San Francisco. The plans for the exhibits were approved by the State Exposition Commission who granted an appropriation to cover the cost of assembling the materials and their installation. It will be displayed on a site of 3360 square feet in the Palace of Mines and Metallurgy.

The exhibit includes a fairly complete assemblage of mine and quarry products — in variety scarcely inferior perhaps to that obtainable in any other state — besides many chemical and metallurgical materials in whole or in part derived from the local resources and much illustrative matter in the way of models, photographs, maps and charts. Although the collection has been brought together with a view more especially to illustrating the technologic and commercial features of the subject, for that is the main purpose to be subserved, nevertheless there is much of popular interest and much attention has been given to the explanation of technical methods and processes so that they will be understood by the general visitor.

The scope of the display as well as the form of the individual exhibits, has been controlled to a considerable extent by the limited time available for preparation and the distance to which the exhibits must be transported. The funds available for the purpose also were less than in the case of some of the previous expositions in which the Geological Survey has participated, although an actual increase in many items of expenditure was to be foreseen.

The exhibits in most instances have been provided by the mining enterprises themselves in conformity with the plans of Mr Newland who has had charge of the exhibit and the efficient assistance of Mr A. C. Terrill as the field representative. The cooperation of the

individual exhibitor has been the important element in the undertaking, and that it has been so freely extended has greatly lightened the task of those in charge as well as added much to the interest of the exhibits, for in many instances it has far exceeded the anticipated results.

The features which have the most popular appeal undoubtedly are the models that illustrate methods of extraction and preparation in current use by local enterprises. Among these is the model of a modern salt works, which represents to scale the plant of the Worcester Salt Co. at Silver Springs and is so constructed as to show the various steps of manufacture as if in actual progress. The making of salt by evaporation of brines is one of the historic mineral industries in the State and one in which New York still holds a very prominent place. A second model shows the operations of salt mining at Cuylerville, Livingston county, where the Sterling Salt Co. is engaged in producing rock salt from deposits that lie at a depth of over 1000 feet. The mine model is accompanied by a vertical geological section from the surface to the salt horizon. The use of salt in the manufacture of soda products — caustic, carbonate, bicarbonate etc.— is illustrated by means of a large colored diagram prepared by the Solvay Process Co. which traces the process from the extraction of the brine, the coal and the limestone through the chemical reactions to the final products, of which representative examples are shown.

The manufacture and some of the important uses of Portland cement are illustrated by materials, models and photographs contributed by local companies and by the Association of American Portland Cement Manufacturers; the display of the latter takes the form of a model of a cement road as constructed in New York State with a background of colored transparencies (illuminated) that depict the various stages of road-building amid typical New York scenery. In the exhibit of limestones and lime manufacture are included some remarkable specimens of calcites both in groups and single crystals from the quarries at Sterlingbush.

An extensive collection of iron ores has been brought together from the more important occurrences within the Adirondacks, the Clinton belt and the southeastern Highlands. The Mineville deposits are well represented by samples of the crude and concentrated magnetites and of the derived furnace products. A collection of minerals and rocks assembled by the engineering staff of Witherbee, Sherman & Co. during a period of several years illustrates the geological occurrence of the magnetites in the eastern

Adirondacks, and a group of photographs contributed by the same company show the surface and underground equipment of the Mineville mines, the sociologic conditions and other features of interest. The peculiar configuration of the largest of the Mineville deposits, the so-called Old Bed, is brought out by a glass model.

The exhibit of titaniferous magnetite from Lake Sanford, although the ore is not actively exploited at present, has current interest on account of the experiments that have just been carried out at Port Henry in its use in the furnace. A full set of the materials employed and the product from the furnace run is included.

The small petroleum industry is represented by samples of crude and refined oils from the fields in Allegany and Cattaraugus counties. A typical oil-well rig, such as is employed in that section, is shown by a model to scale prepared by a pupil of the Wellsville public schools.

The unique garnet mines of Essex county have contributed samples of the garnetiferous rock and the prepared products, among the specimens being a large block of the Gore mountain amphibolite containing several crystals. The uses of the garnet are exemplified by suitable displays.

Graphite is another interesting product of the Adirondacks that is represented. The exhibits illustrate the crude material, its conversion into marketable forms and the various applications of graphite, prepared by the principal enterprise of the kind in the country. Artificial graphite, which is made at Niagara Falls, is also exhibited, as well as a model of the electric furnace employed in the process. Other electro-metallurgical products in the display include carborundum, aloxite and silicon from the works of the Carborundum Company at Niagara Falls.

Among other products represented in the exhibits are pyrite, talc, feldspar, gypsum, slate, building stones and mineral paints. They are shown usually in crude samples as they are taken from the ground and in the various stages of preparation they undergo before being put to commercial use. To illustrate the geological associations and distributions of the various useful minerals a large scale chart of the State in water colors has been prepared which will be placed in a central position for reference. The separate mineral localities are shown by pins with heads of different colors and patterns. The chart is bordered on either side by statistical diagrams giving the relative positions held by New York in the several mineral industries.

The State Reservation Commission at Saratoga Springs will occupy a part of the area that has been assigned to the mining exhibit for a booth in which to demonstrate the recent advances in the therapeutic application of the waters and the results achieved by the commission in the revival of the springs. The cone of the High Rock spring is shown by a model. The natural surroundings of the spring localities are fully depicted in photographs.

III

THE PRESERVATION OF NATURAL MONUMENTS

Some years ago the Director made an appeal to the people of the State through his reports and by special circular, for the preservation of "natural monuments" of noteworthy or exceptional interest. These natural monuments are objects which possess a peculiar educational and scientific value; the extraordinary or unique natural creations which no progressive commonwealth appreciative of its best possessions can afford to have invaded or compromised by the progress of settlement. There is the cliff or hill, ravine or cataract, notable above its fellows not so much for its beauty or majesty as for the lessons it teaches; the tree or grove which may be the last survivor of its kind growing within the boundaries of the State; the swamp, woodland or rocky islet where rare birds are still nesting while their former breeding places have been deserted and destroyed; and so on through a variety of natural phenomena. Unless someone looks after these natural possessions and makes it his business to arouse individual or public concern in them, regrets will come with time and our successors may have good reason to reproach us.

The people of the State have taken upon themselves the conservation of our natural possessions in a large sense as an ordinary matter of public policy. Nearly one-third the area of the State is in public forest; our native beasts, birds and fish are safeguarded by an elaborate and rather intricate array of statutes. A generous and high-minded sentiment has gone much further than this, in creating as public parks great areas of extraordinary scenic attractiveness. Each one of these majestic reservations, now in the custody of the people for their own uses and enjoyment, has meant individual initiative, generosity and sacrifice and, in many cases, long and unremitting struggle within and without the legislative halls in order to convince a sometimes overcautious or uninformed legislature of the wisdom of assuming these public trusts. There are the Niagara Falls Reservation, the Watkins Glen Park, the Palisades Interstate Park, the Saratoga Mineral Springs Basin, Letchworth Park on the upper Genesee river, and more recently the John Boyd Thacher or Indian Ladder Park of the Helderbergs which, like the Letchworth Park, is a fine expression of an individual benefaction to the people of the State.

These great possessions are practically geological parks, for all their merits of beauty and the basis of their effective charm is in their geological structures. Niagara Falls, the "time-piece of the ages," the "geological clock," aside from being the most stupendous exhibit of water power in the western world, has been for generations and is today the object of study by geologists who seek a basis for the reckoning of geologic time, for the rate of action of geologic forces, for the record of changes in the topography and drainage of the Great Lakes basin. Watkins Glen is a deep gorge in the old Devonic shales which has been cut out since the withdrawal of the ice sheet and its inviting, sinuous retreats and deep, shady recesses hid away among graceful rock walls, stand as a monument of the geologic work of erosion done since the close of the Ice Age. The Palisades are an outpoured lava sheet whose prismatic edges have been bared by the flow of the ancient Hudson waters. The Saratoga Mineral Springs Basin, not conserved for its scenery but for the eventual benefit to public health, is an extraordinary geological monument and record, probably nowhere to be equalled in the diversity and abundance of its carbonated waters. Here, running through the village of Saratoga Springs, stands the escarpment of the celebrated "fault," the only outward sign of the controlling causes of these variant waters. Westward across the fissure in the earth's crust made by this fault, none of these abundant saline waters pass. Coming into the Saratoga basin deep underground, they encounter the carbonic acid gas emanating from this fault fissure and with this added solvent power they take the salts out of the rocks in varying degrees, till reaching nearer to the fault itself, they spring out to the surface at any chance, impregnated and supersaturated with the gas. Dead a few years ago because the gas was being pumped away, today they are again full of life and promise, with the hard hand of the law forbidding any further abstraction of their vitality.

Letchworth Park embraces the three beautiful and impressive falls of the Genesee river plunging down through a deep gorge in the rocks — a course its waters took after the ice sheet had blocked and filled up their ancient and easier channel. They too have done all this majestic work since the last great change in our geology, the retreat of the Great Glacier.

Thacher Park conserves a magnificent escarpment in whose rock face is recorded a long chapter in the life history of New York and from whose summit one reads the whole panorama of the great Hudson-Mohawk gateway.

These are our greater natural monuments in the possession and conservation of which this State is rich not only in scenic beauty but in educational service.

But the lesser object, the minor natural feature, may carry a lesson and express a sentiment quite as important and uplifting as the greater, and of these we have added to the public domain some of very notable concern.

LESTER PARK OR THE "CRYPTOZOON LEDGE"

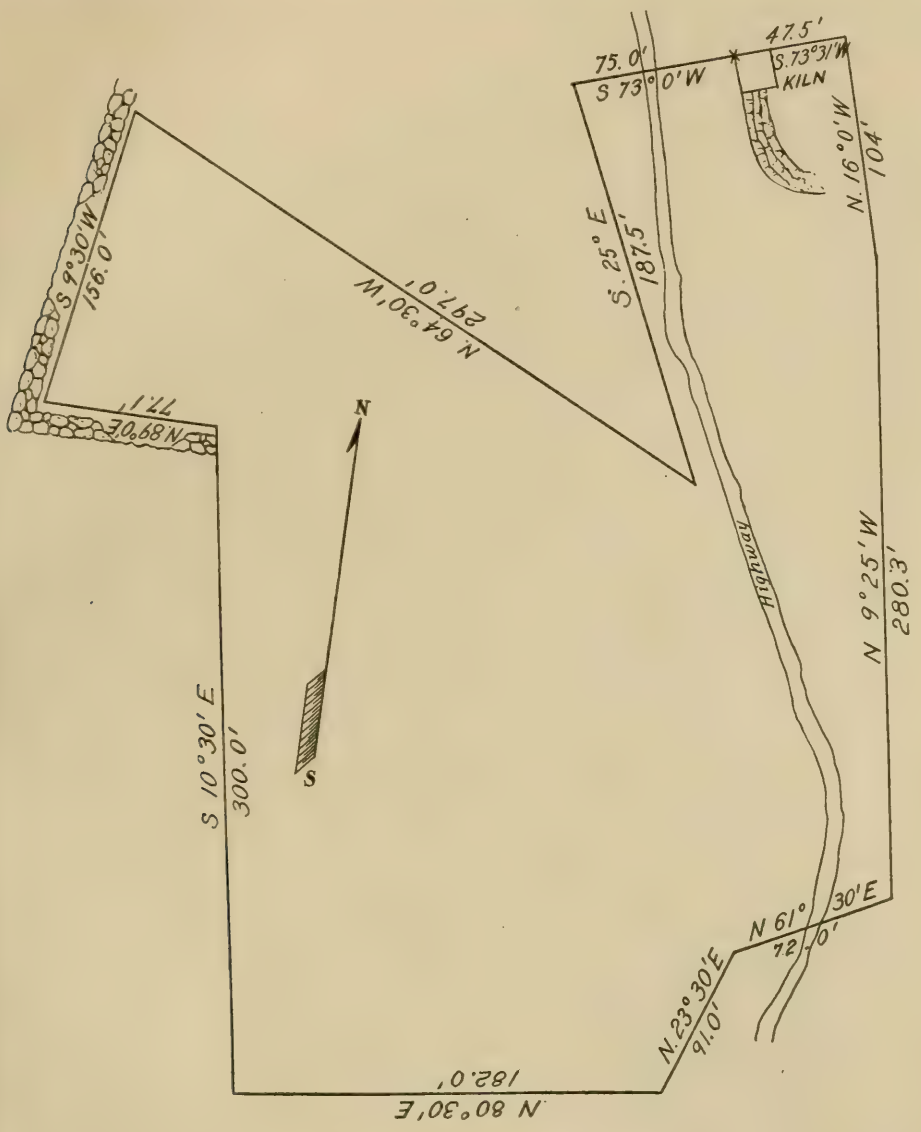
About 2 miles west of Saratoga Springs, in the town of Greenfield, Saratoga county, and just a little turn to the left from the State road, lies the first of these acquisitions. It is the gift of Willard Lester, Esq., of Saratoga Springs, to the Regents of the University on behalf of the State Museum and in trust for the people of the State. To use the language of the deed,

"This conveyance is made upon the express condition that said premises are to be used for the protection and preservation in their present site of the fossils exposed in the limestone strata upon the lands hereby conveyed to the end that they may be always available to the people of the State of New York for purposes of examination and study and to be used for no other purpose whatever."

This area covers about 3 acres of ground which is crossed by a highway and is thus readily accessible to the public. The spot is one of singular natural beauty, bounded on one side by a ravine, on the other by rising hill land, the road leading down into a wooded shady retreat and soon coming back again into the main highway. On one side of the road lies the "Cryptozoon ledge," a broad platform of Cambric limestone covering a half acre or more, smoothed down to a horizontal surface by the wear of the ice sheet. This ledge is filled with the remains of some of the earliest marine plants known to have lived in the ancient seas — lime-secreting algae, known in science by the name Cryptozoon proliferum, — which here grew in such amazing abundance as to form a great calcareous reef not unlike the coral reefs of the present seas. The Cryptozoon grew like great cabbages, in large round heads and in concentric layers, and the cabbagelike plants of this marine garden, dating back to the dawn of the earth, have been sliced across by the cutting edge of the glacier so that the surface of the Cryptozoon ledge presents an innumerable array of these cross-cut plants. The weathering agencies of untold centuries have brought out all their peculiar internal structures, their concentric layers, their buds and offshoots, while the microscope turned upon carefully prepared thin

sections of the fossils may reveal the bacteria which helped in the deposition of their lime.

This place had been long known to geologists for its remarkable display of these very ancient organisms and it is beyond question quite unique in the effective panorama it presents. It had, however,



Map of Lester Park
Property of the State Museum

begun to suffer from invasions by the collector of specimens for museums and to protect it from further incursion the Director asked the owner to transfer it to the State Museum. The answer to this request was expressive of a fine sentiment. Not only was this ledge freely given but to it was added, at the owner's suggestion, a larger area on the other side of the road where lie the higher ledges running out into a natural rock face and rising through a wooded

depression into the front of the old Hoyt limestone quarry — a spot of historic interest in New York geology for from it the name of the geologic formation itself — Hoyt limestone — is derived.

It is the purpose to provide this "Lester Park" with explanatory placards which will make clear its lesson and its interest, and to take such measures as may present the geological display here in its greatest effectiveness.

STARK'S KNOB

At the north end of the Saratoga battlefield, 2 miles above Schuylerville and close to the highway, stands Stark's Knob, a once dome-shaped volcanic knoll on which, on that memorable and decisive field, General John Stark mounted his battery and effectively obstructed the attempts of the defeated Burgoyne to withdraw his forces northward through the narrow valleys of the Hudson and the Battenkill. It is an historic spot. But its geology is of more singular interest. Some years ago its owner leased the knoll to a company that cut into its eastern face to obtain the rock for road metal. Fortunately for geological science the rock, though volcanic, has proved unsuitable for good road construction. The exposure of its substance attracted the attention of our geologists and it became evident that the rock was not merely of volcanic origin but was the actual remains of a single volcanic plug or neck. There is no other volcano in New York. But not this fact alone answered the inquiries of the geologist. It was found that the lava plug lay in between the masses or layers of the Hudson River shale, that its prominence in the landscape was due to the erosion of the shale from about it, but where the lava came from, whether it came up through this ancient early Siluric shale here, a time at which we know of no volcanic activity in this part of the country, or whether it was of later date, were questions which perhaps are not even yet determined but which nevertheless have called for many examinations and conferences of geologists at the spot, many diagnoses of the case after close examination of all the conditions in which the volcano is involved. Geologists who can speak from most intimate acquaintance of the rock and its surroundings are disposed to believe that this volcanic plug did not come up through the rocks at this place. The country is one of great disturbance in its rock structure. It lies in the heart of mountain folds of an ancient type and right here these overturned mountain folds with their thrust faults or planes along which the top of the fold has been shoved over their lower part are very clearly manifested. The

great thrust plane is evident in Bald mountain, just across the river from where this volcano lies. All these folds have been thrust from the east westward. There is, then, the large possibility that this volcanic plug has been cut across by such a thrust fault and has been transported from its original place eastward on the thrusted portion of the fold. If this is true, the rest of the plug is somewhere to the east, perhaps over the state line in Vermont, buried out of present view. Thus some geologists think; others conceive that the lava came up where it is during the Devonic period, like the volcanic hills which dot the St Lawrence plain north of the state boundary, and penetrated overlying rocks now worn away. But whatever the truth, the volcano is a problem still of great geological interest and the effort to save it is timely for the attacks upon it have carried off a substantial part of it, though leaving its present exposure most instructive.

THE CLARK RESERVATION

A glacial park

In the course of the operations of the Geological Survey, the study of the water courses resulting from the melting of the great ice sheet brought into prominence the abandoned gorges and cataract cliffs of the great east and west glacial streams which cut through the rock beds of the Helderberg plateau in the region lying to the southeast of Syracuse and both east and west of the village of Jamesville. These great streams were made while the ice was extending, in retreat, over the basin of Lake Ontario and the valley of the St Lawrence river, and the discharge of these streams was from the west toward the east along the commanding front of the ice sheet and out into the Mohawk-Hudson drainage. The present drainage of this region is by streams which flow from south to north and the old abandoned waterways transect these existing drainage features.

The features presented in this region are extraordinary in more than one sense. They are highly picturesque and their record is that of a great body of flowing water larger than Niagara which made one cataract at least of horse-shoe shape higher than the Horseshoe Falls of Niagara, and the whole strip of country is dotted with the abandoned plunge-basins of subsidiary falls with potholes and the rocky ravines of contributory gorges.

Most conspicuous among these abandoned escarpments is that which surrounds the Jamesville lake and over which a cataract

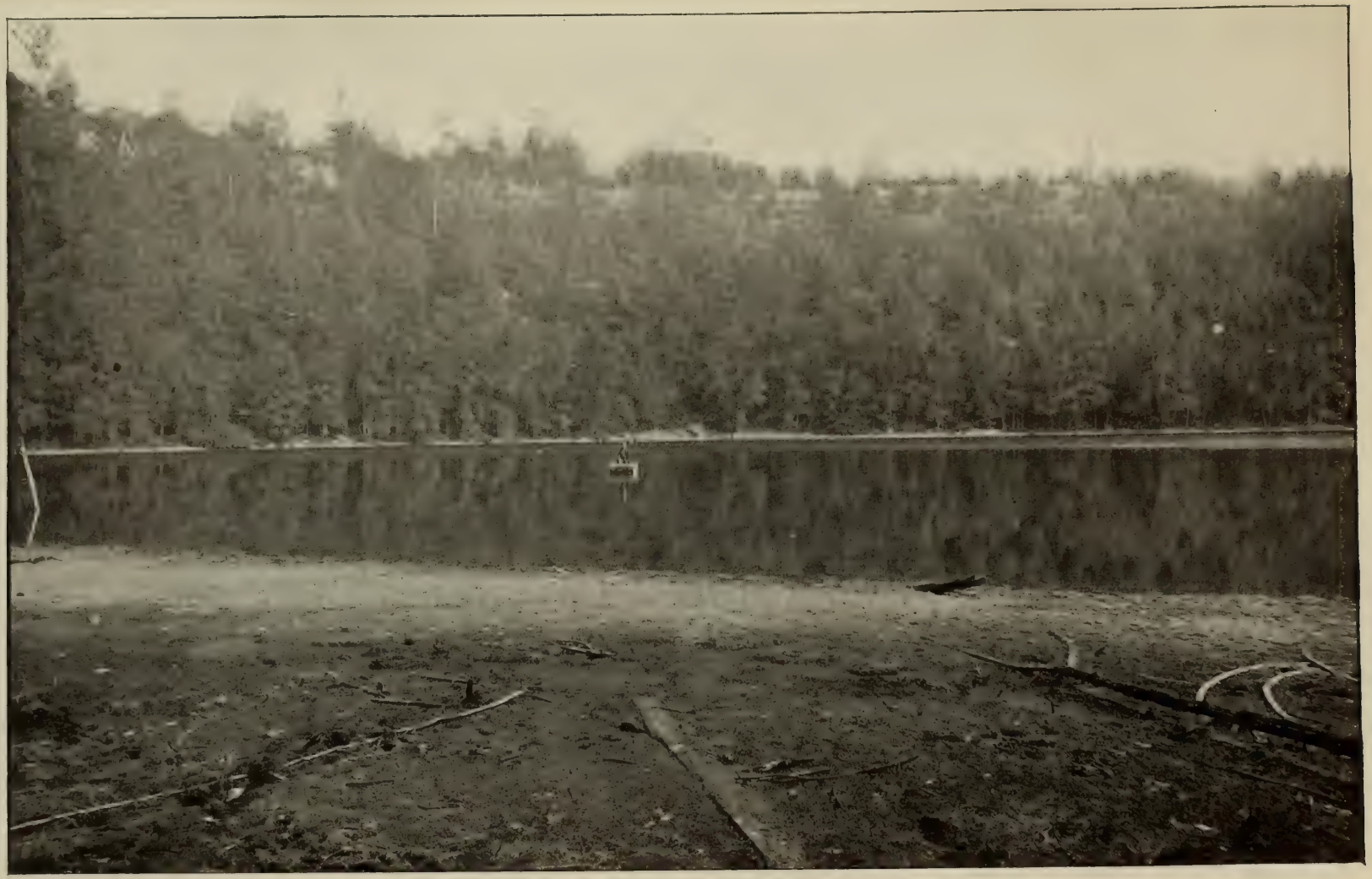
plunged into the lake basin beneath, originally the plunge-basin of the lost river. This lake and others of less size have been commonly known in the vicinity as the "Green Lakes." They reach extraordinary depths for such little water bodies and their water, seldom stirred by storms, is of wonderful clearness, and on days when the skies are blue have a deep emerald green color.

The Jamesville lake, whose water surface covers about nine acres, with its horse-shoe cataract cliff, the smaller "dry lake" to the west, their connecting rock channels and adjoining potholes, have recently been acquired by the State Museum, through the generosity of a private citizen, in order to preserve its extraordinary features from invasion. Unfortunately for the sentiment which attaches to places of this kind and their high educational value, the present increase in the demand for cement and cement rock constituted an immediate menace, and the splendid amphitheaters among these rocks afford a particularly inviting point of attack for such enterprises. Happily for the people of the State, for posterity and for the better sentiment of the community, the appreciative interest of Mrs Frederick Ferris Thompson has prevented the threatened destruction. Mrs Thompson has acquired an area covering about one hundred fifteen acres of land and taking in parts of several farm properties and has made this property over to the Regents of the University as a geological exhibit of the State Museum, giving it without restraint as a memorial of her father, former Governor Myron H. Clark, whose name it is to bear: The Clark Reservation.

The geological history of the place is one of much fascination, and while people were wondering whence these mysterious bodies of water came — these deep, funnel-shaped lakes without inlets or outlets — and what agencies could have caused the singular gorges and majestic amphitheaters, some thinking that they were the abandoned and water-filled craters of old volcanoes, others that these strange caverns were produced by the sinking of the rock beds or the solution of the limestone strata or of the salt beds which lie beneath them, the suggestion as to their true nature seems to have been originally made by Mr G. K. Gilbert. Subsequently Prof. E. C. Quereau, while located at Syracuse University, gave with some detail and illustration the approximate solution of their origin and history. Later in the more protracted and detailed work of the Geological Survey, the portrayal of these east and west channels and their great significance to the geological history of the State has been on many occasions demonstrated by Prof. H. L. Fairchild.

CATARACT BASIN. JAMESVILLE LAKE

View looking across amphitheater from south crest. The height of this escarpment is about 180 feet



JAMESVILLE LAKE. ANCIENT CATARACT

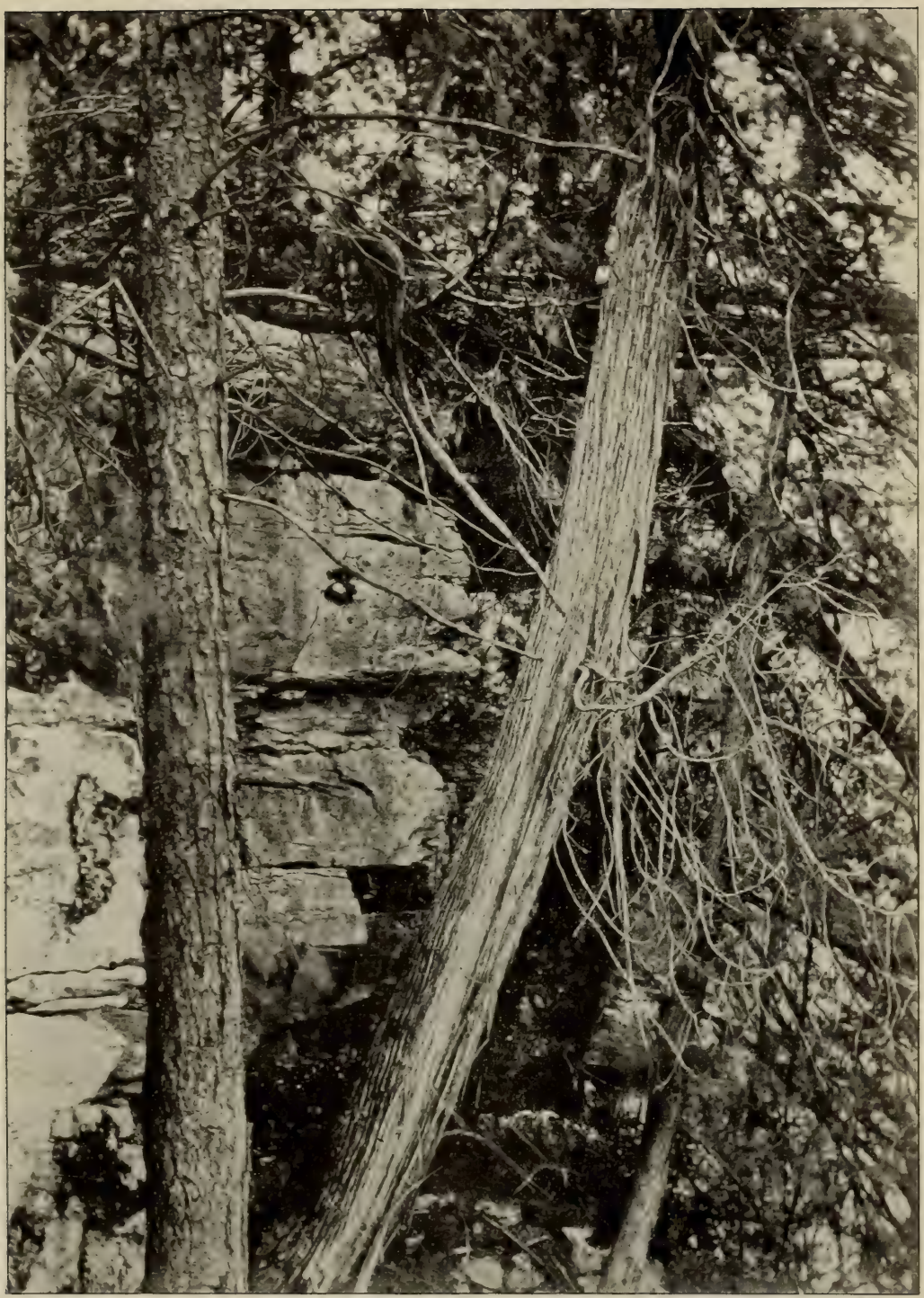
Looking northwest, into the amphitheater

STREAM EROSION IN LIMESTONE

On south crest of Jamesville cataract. Looking northeast

CLARK RESERVATION

The lake, looking southeast

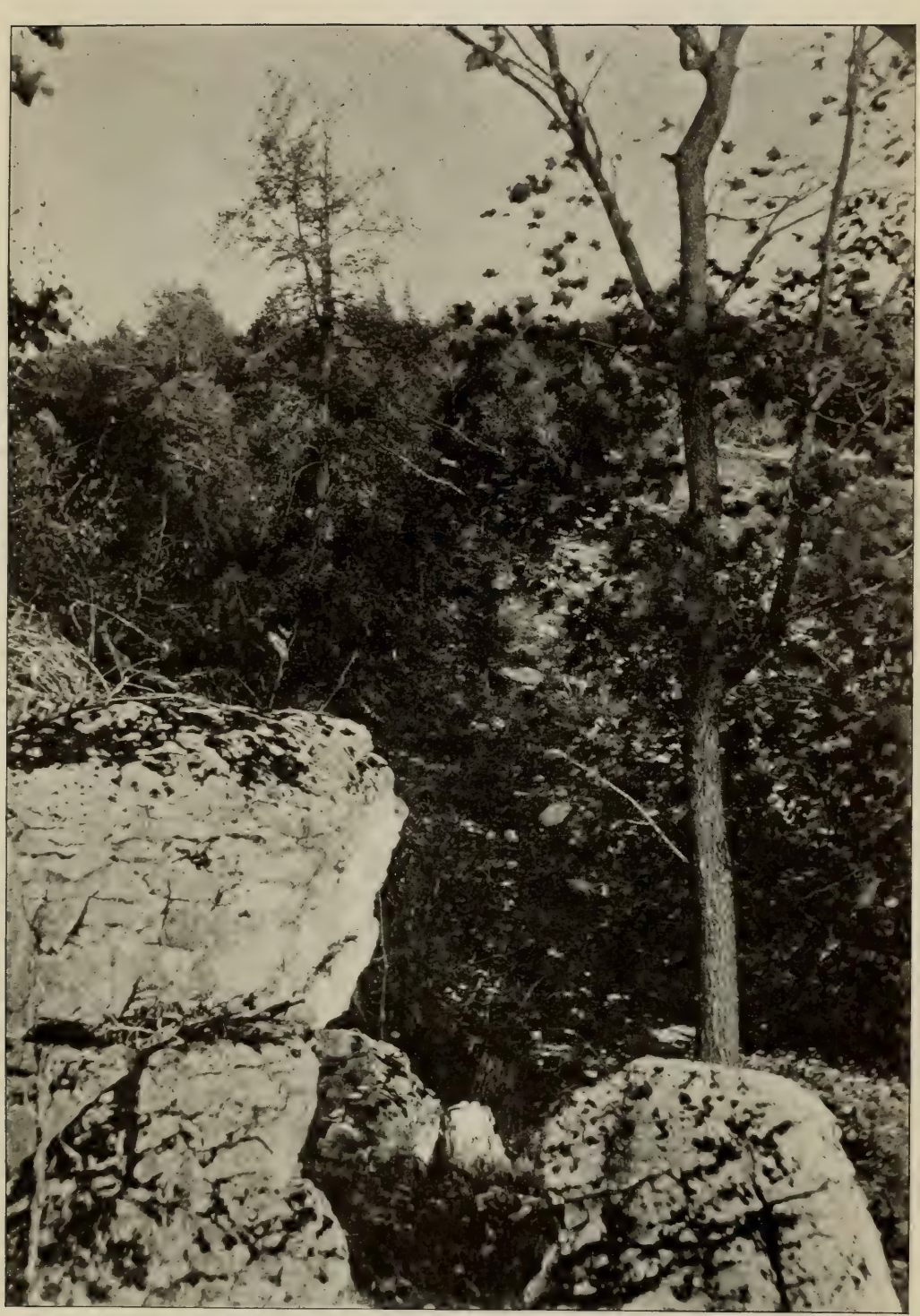


CLARK RESERVATION

One of the caves in the face of the cliff wall

CLARK RESERVATION

Hermit's causeway, or pathway under the face of the cataract cliff



CLARK RESERVATION

The colosseum or the cliff of the "dry lake," 200 yards west of the lake

It is not alone the geological features of the place that are of interest. To the lovers of the wild plants they have long been famous, for in the steep, wooded talus at the foot of the amphitheaters, in the neighboring ravines and potholes and bare rock surfaces, there have been found more rare ferns than in any other part of the State. The State Botanist says that more than forty species of these ferns grow about and within a few hundred feet of one of the Green Lakes — a record unknown from any other locality in the temperate zone outside of California, and one that it is possible to equal only in some tropical or subtropical countries. The flowering plants are present here, too, in a profusion that is not surpassed by the fern life, and among them are many rarely found elsewhere.

LOGAN PARK

Logan Park is situated in the village of Percé on the open gulf coast of Gaspé in the province of Quebec. It was established there to commemorate the service to geologic science through a long life, of Sir William Edmond Logan, founder of the Geological Survey of Canada, who began his official work at this spot. As to the first measures taken to establish this geological park, I may quote the following from the *Comptes Rendus* of the Twelfth International Geological Congress held at Toronto, 1913:

L'idée d'ériger à ce moment quelque souvenir convenable à la mémoire de Logan a été suscitée par le Dr John M. Clarke d'Albany, qui, sur l'invitation spéciale du Dr George M. Dawson, avait été chargé de l'étude des formations géologiques de la Péninsule de Gaspé. Dès le début de ces examens, le Dr Clarke apprit à apprécier le travail géologique de Logan sur ce terrain vierge et à se fier à l'exactitude de la majeure partie de ses conclusions. La proposition courtoise et opportune du Dr Clarke qui était accompagnée d'une souscription très importante fut immédiatement adoptée par le comité exécutif, qui nomma un sous-comité spécial composé de MM. A. E. Barlow, président, W. G. Miller, R. W. Brock et A. P. Coleman qui furent à même, grâce aux souscriptions généreuses des géologues canadiens, de mener à bonne fin le projet.

In accordance with the action indicated subscriptions were raised to an amount necessary to provide a suitable bronze commemorative tablet, which was executed from an effective design by M. Henri Hébert and was affixed to the wall of a striking boss of limestone which rises in the very heart of the village. At the time the tablet was cast it was decided by the committee in charge to make a duplicate and because of the geographical remoteness of Percé

this copy has been affixed to a glacial boulder placed in front of the Victoria Memorial Museum at Ottawa.

After the dedication of the Logan memorial at Percé, the rock to which it was attached and the entire plot of land surrounding this rock were freely presented to the Logan Memorial committee as a public park by the owners of the property, Robin, Jones and Whitman, Ltd. (formerly the Charles Robin Co.) through the active and courteous intervention of Messrs John LeMarquand of Percé and William F. Hamon of Paspebiac, for the company. In response to this generous act the committee agreed to put the property in good order and to maintain it in accordance with the terms of the gift. In due course the property has been transferred to the Crown in the trusteeship of the federal Department of Mines.

The writer was asked by the committee to take all charge of the placing of the memorial, the preliminaries in the acquisition and transfer of the property and the plans and expenditures for the improvement of the plot. The lamented Dr A. E. Barlow, distinguished geologist and chairman of the Logan Memorial committee, the day before he sailed on the ill-starred "Empress of Ireland," transferred to the writer a sum of money raised by his committee to be expended as indicated. With this the park has been carefully cleaned of debris, inclosed by an iron fence with gates both at the main road at the lower end and at the adjoining property on the upper end of the plot, with a walk connecting the two gateways. In the protected corners of the park, Jersey willows have been set out, in the hope that there is protection enough in the lee from the salt winds to let them grow.

The geologic interest of this place lies first in the rock to which the memorial is attached — a projecting vertical ledge of Ordovic or Cambric "edge-on" limestone conglomerate whose sharp contours are rounded by weather and whose broad back is softened by gray and yellow mosses. This rock pierces the sloping surface of the hill in such a way that at the upper end one can mount the summit from the level, while at the bottom where the tablet is placed the rock face rises 30 feet in the air. The surroundings of this little memorial spot are most beautiful. On one side rises the high, sheer, deep red rock face of Mt Ste Anne to an elevation of 1200 feet, while right and left are the sea cliffs with insinuating curves suggestive of the engrossing geologic problems they contain. Above the park and beyond the cliff which hides it from the sea

stands the majestic Isle Percée, the Pierced Rock, most glorious natural feature on all the eastern seaboard.

Thus embrasured amid geologic scenery whose secrets were first unloosed by Logan, the park serves well to keep alive the memory of a great geologist. Logan, born in Montreal in 1798, trained in Scotland and Wales, returned to America in 1837 to study the coals of Nova Scotia and Pennsylvania. Seeing the great possibilities of geological development in Canada, he conceived and executed a purpose to organize an official survey of the public domain, as it then was. This organization became effective in 1841 and he, as its chief, suspecting there was coal to be found in the rocks of Gaspé, began his first season's work on this coast. Instead of finding coal he discovered an amazing series of Paleozoic rocks, similar in character to and an actual extension of those which had just been described by the geologists of the New York Survey in their annual reports from 1837 to 1841. His very first work thus established a common bond between Gaspé and New York which has been and is to be eternal. Similar scientific concerns brought Logan into intimate relations with Hall, the great geologist of New York, and the two men joined hands in many scientific enterprises. It is fitting therefore that New York should join in his memorial.

The Logan memorial was unveiled July, 1913 in the presence of nearly a hundred geologists from all nations of the world brought together by the International Congress, and on this occasion brief addresses were made by Dr A. E. Barlow for the committee, Charles Lamb, Esq., mayor of the town, and by the writer.

THE HUGH MILLER CLIFFS

On the Quebec coast of the Bay Chaleur, just where the broad waters of the Ristigouche river discharge into it, is Scaumenac bay, a long arc of shore bounded at its eastern end by Pointe-a-la-Garde (whose name commemorates the last fight of the "Conquest," 1760), and at its western by Magouasha point. Midway in this arc at the mouth of the Scaumenac river, projects Fleurant point, and from Fleurant point to Magouasha point rise the rock cliffs which have in later years become so celebrated in geology as the depositary of infinite remains of fishes of the "Old Red Sandstone."

Nowhere in the world are these singular fishes so amazingly abundant or so remarkably preserved, and the Scaumenac rocks have become celebrated afar for their wealth of this ancient life. These creatures are like the "Old Red Sandstone" fishes that Hugh Miller portrayed on the pages of his remarkable books,

"The Old Red Sandstone," "Testimony of the Rocks," "Footprints of the Creator," and which he used as weapons to belabor the growing ideas of transmutation and evolution. Hugh Miller was a great Scot; he gave to his generation of three-fourths of a century ago the first lucid account of these Old Red Sandstone creatures, but not only that; he wrote inviting books, not always of science, but always clothed in vigorous and effective diction; he fought for a freedom of thought and action in civic and ecclesiastical affairs. But most of all he remains a great and inspiring lover of the rocks whose influence spread far afield through the English-speaking world.

These cliffs on Scaumenac bay are to bear his name and serve as his memorial in a country which he never saw but over whose foundation stones he labored well. The Hugh Miller Cliffs have, at the writer's suggestion, been thus formally and officially designated by the *Commission de Géographie de Québec* (Bulletin 9:86, 1915).

BIRD NESTING-PLACES ON PERCÉ ROCK, BONAVENTURE ISLAND AND THE BIRD ROCKS OF THE MAGDALEN ISLANDS

As the earnest of an interest which can recognize no political boundaries but is founded in the broad concern for the preservation of nature's works, reference may be here made with propriety to the efforts toward the official establishment of bird sanctuaries on the islands of the Gulf of St Lawrence. As a part of the activities of the Director it is not inappropriate that record be made of these efforts.

There was a time not far back in our history when many of the islands of the Gulf of St Lawrence and the Quebec Labrador were nesting places of clouds of sea fowl, preeminent among which in beauty and abundance was the Gannet or Solan goose. The early navigators of the gulf saw and in their relations made record of these great bird colonies, in terms of astonishment and wonder that such myriads of birds could find room even to congregate on such insulated fragments of land.

But no sooner were these colonies discovered than they and their eggs became the prey of sailor and fisherman and their very contact with humanity has brought about their impending demolition. All the world knows the fate of the Great auk, the first member of these colonies to be totally extinguished by the hand of man. Audubon, three-fourths of a century ago, seeing the destruction going on among them by the ruthless robbing of nests at all these spots, cried out against it and foresaw extinction for all these races.

Then it was the Gloucester fisherman and "egger" who was carrying away the eggs by the hundreds of thousands every year, to be sold in the Boston and New York markets. Such vandal procedures lessened in extent as the Gloucestermen left these waters but the lessened possibilities of reproduction have nevertheless vacated all the islands and cliffs in the St Lawrence of these birds except for the colonies named above.

Of these three populated islands two have the same coterie of bird citizens: the Bird Rocks of the Magdalens, in the heart of the gulf, and Bonaventure island, 3 miles off the Gaspé coast at Percé. In them both the Gannet predominates; and with this beautiful bird are associated the Kittiwake, Guillemot and Murre, the Razorbill auk and the diminutive Puffin; a venerable association from which only the Great auk is missing. The Bird Rocks colony is on the ledges of a most isolated solitude in the very heart of the gulf, and yet this fact has not protected its population from decimation. Lovers of bird life who have studied the spot estimate its present census as not above 15,000 for all birds and it is more than doubtful if the Gannet constitutes one-half of this number. The stories of the old days led the reader to believe that the birds were without number and it is evident that in Audubon's day the number was many times greater than now.

The colony on Bonaventure island has, on the other hand, obviously grown in the number of its gannets within the writer's personal acquaintance with it during the past ten years or more. Today the Gannet colony of Bonaventure island is the largest in America. It is lodged on the seaward steep ledges of the island but while its cliffs are steep and difficult of access, its nearness to the mainland with latter day conveniences of motor boat travel menaces its integrity and every season the cliffs are befouled with the brutal destruction of the birds by the tourist, the fool with a gun who can not be restrained from shooting into the beautiful array upon the cliffs merely to see how many birds he can kill.

The Percé rock at Percé presents a different bird colony composed of only two elements, the Herring gull and the Crested cormorant. It is needless to describe the majesty and wondrous beauty of this great insulated stock; its features are without parallel. On its summit only, nest these two species of birds, close to the habitations of men, and growing fewer in number because of it.

The issue (long hoped for by many friends of these relict colonies) as to whether these birds were to have the protecting arm of government thrown about them, through passage of some penal-

izing prohibition or by withdrawing the nesting places into public reserves or sanctuaries, was brought into active prominence in the winter of 1913–14 by an official order condemning to destruction the Cormorant colony on the Percé rock because of its alleged sin in devouring the fry of the salmon. This allegation of offense was based upon assumption — the act has never yet been proved and indeed recent examination of these very Percé cormorants by Mr Taverner has, he tells me, disproved the accusation in all the birds (some thirty) which have come under his dissecting knife.

That the writer interested himself in the first efforts made to claim the innocence of this grievous allegation against birds whom nature made to live on fish, is less to the point than the fact that after having urged the arguments for protection as best he could in quarters of influence, he responded to an invitation from the Commission of Conservation of the Dominion of Canada to present a plea for the protection of these notable spots, and the address given on that occasion follows:

Protection of the sea fowl of the Gulf of St Lawrence

The matter before our minds at this time is so wholly grounded in sentiment that it may seem of diminutive importance in the face of an overwhelming human issue. Whatever may be the turmoil abroad in the world, it can not change the fact that the attitude of government toward the protection of its natural resources is an index of its best attainment. This is all the more true of an assumption which presents no possibilities of a commercial or material benefit. We recognize the fundamental proposition that the government which does not early see the importance of restraint from overindulgence in the bounties of nature and its seemingly inexhaustible possibility of wealth, is negligent and even suicidal. Time teaches the necessity of such restraint with the visible, and practical economy soon develops the imperative demand for uncovering the invisible, resources of the earth. The impetus to make a country yield its full flower and fruit in every direction with which nature has endowed it, has been productive of the finest scientific efforts which civilization has wrought out.

Now, however, is a different proposition: to save to the world certain species and groups of waterfowl, now traveling the rapid road to extinction. If they are not saved, who can say the world is poorer in a material or commercial sense? If they are saved, protected and allowed to propagate and keep possession of their ancient domain, who can say that the world is in any wise materially the richer? The birds that frequent the remarkable breeding places in the Gulf of St Lawrence — the venerable Bird rock, the most ancient monument of Canadian history, the cliffs of Bonaventure island and the dramatic Percé rock — are no special profit to

material concerns of humanity; no one can eat them, their eggs are no longer of moment as a source of food supply; and, indeed, some of the members of these remarkable colonies are under present indictment of living too freely on the young fry of the salmon streams; thus, it is alleged, invading human happiness.

The races of these birds are on that easy road that leads to destruction. The appeal, then, if they are to be saved, must be to the trained sentiment which deprecates and mourns the destruction from off the earth of any of nature's creations; which, as one might say, gets the proper angle and apprehends their significance in the great scheme of life. In every civilized community there is a large, a very rapidly growing and perfectly comprehensible sentiment that would protest against a needless and an entirely avoidable destruction or waste of these products of creation. Such a sentiment is a natural emotion; it springs both from a sympathy inborn with our aboriginal state and from an acquired appreciation of the ages of labor and experiment on the part of nature in trying out her methods and her products until these ends have been reached — ends, indeed, which, though seeming final, may actually be mere passing stages on to something better.

In a young country as large as ours where population and settlement have been making a hard fight against the embarrassments of the wilderness, it is natural that immigrants and invaders should have shown a disregard of native life in so far as it fails to contribute to human comfort; but the fact is an open one that the more dense the population, the more highly cultivated the state of the land, the greater becomes the abundance of wild life — a fact evident throughout European countries where, in the midst of a thick population, native races of birds, beasts and fishes are preserved in probably greater abundance and variety than even in new lands like this.

Our course here toward our native races of birds has been historically incorrect until these later years. We have already permitted the total extinction of some of our native birds and the reduction of others to such scattered remnants that extinction at an early date seems unavoidable unless the arm of the law can reach farther than it is now doing.

We have suffered serious permanent losses from our American bird fauna. From the islands of the Gulf of St Lawrence, first and foremost, the Great auk and the Labrador duck. Today the Passenger pigeon, once, as we all know, so tremendously abundant in this country and such an obstruction to the ordinary operations of the struggling farmers as (it is reported by Lahontan) to call forth the excommunication of the bishops, is gone. The Wild turkey, sacred to the Puritan harvest feast, is exterminated from Canada; the Whooping crane, the Trumpeter swan, the Golden plover, the Hudsonian godwit, are all nearly extinct; the Willet and the Dowitcher are on the same declining path.

Now, so far as our birds contribute to the protection of our commercial assets, in so far as they prevent by many millions of

dollars in annual value the destruction of our agricultural crops, our forest and shade trees through the incursions of noxious insects, just in so far there is an imperative reason why they should be safeguarded by every restraint within the power of the people. No argument is needed and no defense is required for the much talked of "restriction of personal liberty" in the destruction of insect-eating birds. We have reached and passed that point. Nothing can so irrevocably restrict personal liberty to hunt and shoot as the entire destruction of game, and this very selfish consideration alone is efficient in the execution of the protective laws; and yet it is questionable whether our restrictive measures have been taken in time to be fully effective.

There is a fundamental principle here upon which the effectiveness of game laws and general protective methods must be estimated, and it is the sole criterion by which we can be guided. No system of protection can be efficient if under it the native birds or animals are still diminishing from year to year. Such a condition would be of itself proof that we are destroying more than the annual increase and using up both interest and capital; and it is to my mind an open question whether our present laws have up to this time been effective in this regard. So much they have effected, that the falling off of the native races is less rapid, but there is an actual annual diminution, even though in some instances small, and progressive diminution spells extinction. I can not undertake to speak of the relative merits of general laws of protection, but incidentally may observe that in my own state the inefficiency of the general protective laws outstanding for some years past has led to later very severe and stringent regulations in virtue of which it has become an offense to destroy any of the native races of birds, with discriminations against an exceedingly small number regarded as reckless in their disregard of agricultural and fishing interests. I refer to this law without any special reference to open and close game seasons. But I would like to say another word regarding the existing system of protective laws in respect to its failing to meet the requirements of adequate bird protection. If we can not through the laws sufficiently reduce the destructive agencies acting upon species which are actually vanishing, particularly a considerable number of our game species whose fate now hangs in the balance; if we can not instil into the pot-hunter, the resident or citizen foreign to our mode of thought and our high purposes, of the man out of the reach of observation, who thinks to deceive others while indulging himself; if we can not make the executive effect of our laws reach into those remote corners where these native races are propagating, we must turn to, and by the encouragement of a proper spirit and sentiment amongst our citizenry, where the law itself can not much help or hinder, encourage, not merely actual respect and regard for these races but active interest in their preservation by the erection and protection of places which are to be totally exempted from a hunter's privileges. Preserves, reservations, bird sanctuaries, places of refuge where such security can

be afforded, become more and more a necessity as the remoter regions of our land become more readily accessible and more fully settled.

Our governments, yours and mine, in the splendid national parks which have been set apart, have furnished almost ideal conditions for the safe reproduction of the species of birds that naturally inhabit them, but these are great parks and from their size and cost of maintenance must always be too few in number sufficiently to supplement other means of protection. We find growing up about us in the wholesome development of public sentiment on this matter of protection, private refuges for bird and beast, and I count it among these wholesome developments of our civilization that these reserved spots on this estate, on that private domain, a breeding place near some municipality taken in charge by some private organization; that such refuges as these are increasing; and I find, too, in such a proposition as has been brought to the attention of the Province of Quebec by Colonel Wood regarding the sanctuaries or refuges for the native races of animals in the Quebec Labrador, a fine expression of the earnest desire and purpose of the lover of nature to protect the works of nature.

Now it is needless for me to say that small areas taken at random can accomplish much toward the preservation of our natural bird species. To be effective, a small reservation must be located at some point to which the failing species themselves have made resort for the especial attractions and facilities the places offer for their multiplication, and this brings us immediately to the consideration of the islands of the Gulf of St Lawrence and their bird colonies.

Time was in the early days when all the islands off the coast of the gulf and in the gulf and off the coast of the Labrador, were to our Atlantic coast what the islands of the Hebrides, Saint Kilda, Ailsa Craig on the west and Bass rock on the east of Scotland, the Skelligs off Kerry, and its neighbors off Devonshire, all these islands with their wondrous colonies of these very birds with which our attention is now concerned, have been to Britain.

The present condition of the Gulf of St Lawrence nesting places

The Bird rocks

These islands, constituting the northernmost member of the Magdalen islands group, belonging to the county of Gaspé and lying 120 miles out in the gulf, consist of three isolated rock masses, the first or the Great Bird, covering about 7 acres, and the Lesser Birds, which are two bare rock masses, lying close at hand on the west and being little more than rock reefs. The Great Bird has no human population except the lightkeeper and his attendants. The bird colony here consists of several species of waterfowl of which the Gannet or Solan goose is preponderant, the others being the Razorbill auk, the Puffin, the murres and the Kittiwake.

In the days of the early settlements, this "Isle-aux-Margaulx," as it was called by Cartier, housed an enormous and numberless

colony. When Audubon visited the place in 1833 he found and made record of what was not generally known at the time, that the attacks of the eggers upon the Gannet nests here and elsewhere, particularly on the Labrador coast, were confiscating some hundreds of thousands of eggs annually which were sold in the New York and Boston markets. These attacks have undoubtedly been the cause of the extinction of the Gannet roosts on the islands and coasts of the Labrador, on Perroquet island and on the Grand Manan. Since the establishment of the light on the Bird Rock the attacks of the eggers on this colony have diminished, but the colony has been and is yet exposed to the demands of the fishermen for eggs and to the incidental killing of the birds.

The history of this bird colony has been fairly summarized in the recent publication, "The Gannet," by J. H. Gurney, F.Z.S. (London 1913), and the statement there incorporated in regard to the census of the colony ten years ago, quoted from observations made by Mr A. C. Bent, would make the total of the colony about 10,000 birds, of which there were

Gannets	2500
Kittiwakes	2000
Razorbills	1800
Brunnich murres	1600
Murres	1400
Ring murres	100
Puffins	600

My visits to this colony have been of more recent date, 1910–11, and without attempting to make an estimate of the total population, I believe that the Gannet element in the colony is larger than above intimated and that the total census of the birds would probably not fall below 15,000. In my judgment, the colony is not at the present time decreasing and I think this is due largely to the comparatively few visits being made in these latter days to these islands by collectors of birds and of birds' eggs.

Protection. The greater Bird Rock with its adjoining islands being Crown land, guardianship could, in my judgment, be most efficiently accomplished by assigning that duty to the inspector of fisheries on the Gaspé coast, Commander William Wakeham. Commander Wakeham having a cruiser at his disposal is more frequently in the Magdalen islands than any other official of the government. Having supervisory functions, he could, with the aid of the light-keeper as guardian on the ground, exercise a forcible supervision and protection of the place.

Bonaventure Island

The bird colony on Bonaventure island has the same constitution as that on the Bird Rock. This island lies 3 miles off the coast from the village of Percé; it is private property and its area of about 6 square miles is practically held in fee by the present occupants, among which is one of the oldest fishing establishments on the gulf.

During the past summer, at the instance of the Natural History Survey, Mr P. A. Taverner, with his assistants, made a special study of this colony, the breeding habits of the birds, and endeavored to make an approximate count of the number of birds there living. Again the Gannet is paramount in numbers, and I believe I am correct in stating Mr Taverner's judgment, subject to reservation and correction, that the Gannet population on the island is approximately between 7000 and 8000. This is a very much larger number than is assigned to the gannets of the Bird Rock colony and intimates that the Bonaventure colony as a whole (assuming that there is approximately the same numerical relation amongst the other species there nesting) is by very much the largest colony of these waterfowl in the gulf, and hence on the Atlantic coast of North America.

This colony finds its nesting places on the vertical eastern ledges of Bonaventure island, which rise sheer to a height of about 400 feet, and they stretch over a length of about a mile and a quarter. They are well protected from above, but now that the day of the motor boat has arrived, they are bare and exposed from below, and the destruction which has been inflicted upon them of late years by "the fool with a gun" has been appalling. This statement will, I believe, be verified by the investigations and reports of Mr Taverner.

The protection of this very remarkable, if not altogether unique nesting place, presents some provisional obstacles in the way of administration. I have secured from the property owners a provisional promise to deed the ends of their lots bounding the bird ledges in exchange for the construction of a fence near the edge of the cliff which would prevent their sheep and cattle from falling over. I am prepared to assure the erection of this fence, but the proper administration of this property thus deeded for a specific purpose and the maintenance of a warden are matters still open for determination. If it lies within the powers of the Division of Parks to assume protection of these bird ledges as such, without incursion upon the property rights of the owners of the land, such action would, in my judgment, be the simplest solution of what has appeared to me a somewhat complicated problem.

Because of the accessibility of this colony, its great and apparently increasing size, it is now recognized as one of the wonders of the gulf coast and is daily visited during the tourist season; all of which facts seem to demand early and vigilant action for its protection.

Percé rock

Percé rock, off the village of Percé, constituting the most dramatic scenic feature on all the Atlantic coast, is the abode of a colony composed of two species, namely, the Herring gull and the Crested cormorant. This ancient and venerable assemblage has been here since the beginnings of human history on the coast, and the upper

surface of this rock has never, so far as records show, been the breeding place of any other species.

A year ago an indictment was brought against the cormorants of this colony, accusing them of destroying the young fry of the salmon in the many salmon streams of the mainland adjoining. The indictment was followed by an order, subsequently suspended, to destroy the cormorant colony.

The investigations of ornithologists have failed to prove that the Cormorant feeds specially on the young of the salmon. After somewhat diligent inquiry of authoritative sources, I have failed to find any ornithologist who would say that this accusation has been proved, and I think I may take the liberty of saying that the investigations of Mr Taverner are not confirmatory of the indictment.

Percé rock, for its unique beauty, for its extraordinary scientific interest, and for its bird colony, presents strong claims for reservation. The fishermen along the coast do not regard these birds as their enemies. They help themselves, now and again, it is true, to the contents of the herring nets, but where herrings occur in untold millions and the birds were created with a necessity for fish food, the damage to human interests through these agencies is certainly negligible and the birds are so intimate a part of the human interests of the countryside, that I may express with confidence the feeling of the fishermen as wholly in their favor. Yet, this colony is exposed to constant attacks, for the young gull, a favorite viand with the fishermen, when on the beaches still unable to fly falls an easy victim to their attacks.

Protection of the Bonaventure and Percé rock colonies. In presenting the claims of these bird colonies to your consideration, it seems proper that I should recommend also to your notice a practicable procedure concerning their guardianship. A single warden is all that will be required for this purpose, and there lives on Bonaventure island a descendant of the original owner of the island, whose interest in these birds is very keen. He is daily back and forth from the island to the mainland, is known to me to be faithful and trustworthy and efficient, and he is by all means the best man to act in the capacity of warden of these two nesting places during the months of the presence of the birds, from April to October inclusive.

BOARD OF GEOGRAPHIC NAMES

DECISIONS

BEACON. In the matter of the application of the Central New England Railway Company for the change of the name of the station *Fishkill Landing* to *Beacon.*

Decision. In view of the erection of the villages of Fishkill Landing and Matteawan into the city of Beacon, the Central New England Railway Company is authorized to change the name of its station *Fishkill Landing* to *Beacon.*

ERITOWN. In the matter of the application of the New York Central and Hudson River Railroad Company for the change of name of *Erieville,* Madison county, to *Eritown.* This application was accompanied by a petition of citizens.

Decision. In view of the confusion arising from similarity in the names of Erieville and Earlville on the same (Chenango) branch of the West Shore Railroad, and for the additional reason that the proposed term *Eritown* embodies the christian name of Eri Richardson, one of the first settlers of the place, the desired change is approved.

LINDA. Communication from United States Geographic Board recommends the use of the name *Linda* for an island in the St Lawrence river about 2½ miles northwest of St Lawrence village, Cape Vincent township, Jefferson county, sometimes called Britton's island.

Recommendation approved.

MOSHIER. The United States Geographic Board recommends the name *Moshier* for certain ponds in the town of Webb, Herkimer county, in preference to *Mosher, Mosier* or *Moshiers.*

In view of the fact that *Moshier* is the correct spelling of the surname of the guide for whom these ponds are named, the recommendation was approved.

NISKAYUNA POOL. Communications received from Willis T. Hanson, sr and E. W. Rice, jr, Schenectady, N. Y., requested the change of the name *Peck lake* to *Niskayuna lake. Peck lake* is a name which had been applied to the sheet of water formed by the closing of the barge canal dam at Visscher Ferry. It appeared that the canal officials gave this name probably in recognition of one of their superior officers. The remonstrances made by the gentlemen named were based on the ground that the name is neither euphonious nor carries any association of local interest. Subsequently the trustees of the Schenectady County Historical Society passed a resolution appointing a committee for the pur-

pose of urging that this body of water be given the name *Niskayuna* or some other appropriate historic name.

Decision. It was the view of the Board that the term "lake" should not be applied to such artificial bodies of water, but that in view of their character a better procedure would be to apply to them the designation of "pool," and the employment of the term *Niskayuna pool* was recommended in place of *Peck lake.*

Railroad Mills. A petition signed by a number of citizens in the vicinity of the railroad station known as *Railroad Mills,* situated on the Auburn branch of the New York Central Railroad, requested the change of this name to *Glendale* or *Wildwood.* These names were disapproved by the board as being both inappropriate and commonplace. Meanwhile, as it appeared from a personal examination made by one of the members of the board that Railroad Mills is merely a road crossing and flag station with no post office or settlement attached, and that the present name has stood for a half century and serves the purpose of a local designation, and further that the request was based upon a desire of the land owners in the vicinity to effect the train service at this place, it was regarded by the board that the request was not serious and no action was taken.

Aurelius. The following correspondence has passed with regard to the change of the name of *Aurelius* to *Relius* by the officials of the New York Central Railroad:

> The State Board of Geographic Names desires the cooperation of your road in restoring to its proper form the name of *Aurelius,* on the Auburn branch, which now appears in your time tables as *Relius.*
>
> As you are aware, Aurelius is one of the many names taken from Greek and Roman geography and biography that were imposed upon New York by the land offices of the early days. These names have now been standing so long — all of them for over a century — that they have become a part of the political geography of New York and have established their right to remain. The mutilation of the name Aurelius has doubtless resulted from an easy shortening of the term which would have remained entirely local had it not received the approbation of your road by the spelling adopted in your time tables. As you may remember, the first departure from the correct usage appeared in your time table under the form of *'Relius,* the apostrophe thus indicating the decapitation of the word.
>
> The State Board of Geographic Names regrets and deprecates such a mutilation of the venerable place name and as nothing is accomplished by its adoption, no business facilitated, no convenience afforded, we desire to reinstate the name in its proper and original form.

An excerpt from the reply to this communication follows:

> From an operating standpoint there is serious objection to changing the name of Relius back to Aurelius. This name was changed to Relius some few years ago on account of the possibility of operators, conductors and enginemen making errors in the handling of train orders, the first two letters of the words Auburn and Aurelius being the same.
>
> It is for this reason that the name of Marcellus, another good old name, was changed to Martisco at the same time on account of the possibility of this name being confused with Camillus.

From the above correspondence the attitude of the New York Central Railroad toward the mutilation of the place names along its lines is made a matter of record.

SWASTIKA. The attention of the board having been brought to the establishment of a post office in Clinton county under this name, subsequent to the date of the enactment of the law governing the board, inquiry was made of the fourth assistant postmaster general regarding the procedure in this case, and as the reply received did not afford any explanation of the matter in question, a communication was sent to the postmaster at "Swastika" communicating a copy of the law and advising him of the necessary procedure in the change and establishment of such names, in reply to which, in due course, a petition was submitted to the board, signed by a considerable number of residents of Black Brook, Clinton county, asking that the change of *Black Brook* to *Swastika* be approved by the board.

Decision. On the ground, first, that the term "Swastika" has no appropriate association with or significance in the history or geography of New York, the board disapproved the proposed change and filed a copy of its disapproval with the fourth assistant postmaster general. A subsequent communication from the petitioners expressed a preference for the name "Balsamdale," which was approved by the board.

It is a matter of interesting record that the United States Department of the Postmaster General has declined to recognize the ruling of the board, as the post office was continued under the name of *Swastika*. Correspondence in regard to this matter was closed by a communication from the secretary of the board to the county clerk of Clinton county calling his attention to the fact that the name *Swastika* had not been established in accordance with the requirements of the New York State statute and that *Balsamdale* was the statutory name of the place and that the citizens should be advised of the propriety of petitioning the Postmaster General to substitute the legal for the illegal name.

IV

REPORT ON THE GEOLOGICAL SURVEY

AREAL GEOLOGY

The past year has again made necessary some shortage of usual activities in the geological survey of the State, which has for its principal objective the completion of the map on the scale of one mile to one inch. The State of New York is very large and a one inch scale map means that field work in representing the distribution of the geological formations and in making proper discriminations of such formations so that its geological history may be easily read, shall be carried out with the closest attention to detail. The topographic or base map of New York is divided into 260 quadrangles, of which number about one-third have been covered by the geological survey up to the present time. This work should unquestionably progress more rapidly, and it will do so when the financial condition of the Department is such that the greater share of the appropriation can be allotted for it. A larger number of expert geologists and very greatly increased facilities for printing are required for the Department surveys in this direction.

The field work on this survey has progressed during the past year in western New York where Mr D. D. Luther has brought to a conclusion his work in the region between Rochester and Buffalo. Mr Luther's reports, not yet published, cover the quadrangles designated as Brockport, Hamlin, Albion, Oak Orchard, Medina and Ridgway.

In northwestern New York Professor Cushing carried to completion the areal mapping of the Brier Hill, Ogdensburg and Red Mills quadrangles. The larger part of the area is occupied by early Paleozoic rocks, and the results on the Precambric rocks were reported a year ago. Some novel details have developed in the Paleozoic rocks.

The Potsdam sandstone continues across the area with much the same character that it has in the Alexandria and Clayton regions farther west. It was laid down on an irregular floor and is thin. The overlying Theresa formation, on the contrary, shows very considerable differences when compared with the same more westerly area. There it was thin, 30 or 40 feet only, and overlaid by an equal thickness of beds which the fossils indicated to be of Tribes Hill age, corresponding to beds in the Mohawk valley regarded as

of lowermost Beekmantown age. On the Brier Hill sheet the Theresa beds thicken and become more sandy, and are followed above by a sandstone, 20 feet thick, and sandy dolomites which carry a large fossil gastropod sparingly. This is, according to Ulrich, a quite distinct formation from the underlying Theresa, and considerably younger, the gastropod indicating an age either very late in the Ozarkic, or very early in the succeeding Beekmantown. The specimens so far found do not suffice for precise identification; but no fossils of the type are known anywhere in rocks as old as the normal Theresa. The zone is, so far as known, a new one in the New York section.

The Tribes Hill formation occurs but sparingly in the district. But a few thin patches of it have been noted on the Brier Hill sheet. Across the Ogdensburg sheet it thickens, but the heavy drift cover there hides all the formation with the exception of two or three scattered outcrops which give no idea of its thickness or importance.

Unconformably overlying these formations, with a very varying thickness of the Tribes Hill underneath, comes a much higher Beekmantown formation which we are proposing to call the Ogdensburg formation, the new name being necessary because both it and the Tribes Hill are of Beekmantown age, and yet are separated by a considerable unconformity. Nearly the entire formation is well shown in the river sections within 2 miles of Ogdensburg. From here the formation runs continuously down the river below Ogdensburg, but the country is so heavily drift covered that outcrops are few and thin and give but little knowledge of the formation. Hence dependence for our knowledge of the formation will have to be chiefly upon these excellent exposures just west of Ogdensburg. Not only are the exposures excellent but the formation is unusually fossiliferous for a Beekmantown formation, and the fossils are unusually well preserved.

The formation consists of thick beds of granular, blue-gray dolomite, alternating with thinner bedded, fine-grained, iron-gray layers. Four or five distinct fossil zones have been recognized; Ulrich has determined the species and correlates the formation with division D of the Beekmantown of the Champlain section. He states that "the fauna of division E is not even suggested, while none of the species are of those which are particularly characteristic of the fossil beds at Fort Cassin."

The Survey has had the services of Professor Chadwick on the Canton quadrangle, next east of the Ogdensburg area, in completion of the work on the crystalline rocks which, during the previous

season, was in charge of Mr Martin. The quadrangles mentioned may be considered now to have been completely covered and the reports thereupon practically ready for publication.

In the central Adirondack region the Blue Mountain quadrangle was surveyed by Prof. W. J. Miller in continuation of work begun the preceding season. There are certain important details registered for this region which may be indicated as follows:

Grenville series. Two extensive belts of Grenville limestone with associated hornblende and pyroxene gneisses have been mapped in the southern half of the quadrangle. One of these occupies the broad valley around Indian Lake village and extends westward up the Cedar River valley for fully 11 miles, and the other reaches from Blue Mountain lake eastward across the quadrangle by way of the Rock River valley, the two belts being joined through the valley south of Rock lake. Smaller areas of similar Grenville rocks occur in the vicinity of Unknown pond and in the vicinity of the Chain lakes. Also a little Grenville gneiss was found in the extreme northeast.

Syenite-granite series. Rocks of this series comprise by far the most of the region. They range from a basic, gabbroic facies to a truly granitic facies. Granite porphyry was found in one small area only. Certain of these rocks show interesting relations, but they still await microscopic examination.

Gabbro. A number of gabbro stocks or dikes of the typical Adirondack sort were discovered in addition to those reported for 1913. At two localities northeast of Long Lake village there are considerable masses of peculiar, light-gray, coarse-grained, basic, igneous-looking rocks which, at the present writing, are still of rather uncertain age and origin.

Diabase. No diabase dikes were located in addition to the two already reported from the shores of Long lake.

Structural features. Though quite variable, the strike of the foliation is in a general way nearly east-west over the quadrangle, the dip in the north usually being southward, and in the south usually being northward.

Three faults only could be definitely located, two across the southeastern portion of the quadrangle and the third already reported as passing through Long Lake.

Glacial and postglacial features. In all, 18 sets of glacial striae have been located. These range from south 20° to 50° west, and are so situated as to prove that the great ice current across the region was southwestward. Well-rounded glacial pebbles of

Potsdam sandstone were occasionally noted at altitudes of from 2500 to 3000 feet.

Certain interesting glacial deposits, extinct lakes, and drainage changes will be fully described in the forthcoming bulletin on the geology of the quadrangle.

In addition to the work above indicated, there are complete or progress reports on the surveys of other quadrangles: Utica, by Burton W. Clark; Mount Marcy, Ausable and Lake Placid, by Prof. J. F. Kemp, who has nearly concluded the work upon the first of these and has the other two well forwarded; and Tarrytown, by Dr Charles P. Berkey. The general geological survey of Long Island has been going forward for a number of years past, on the basis of an agreement with Prof. W. O. Crosby representing the New York City Board of Water Supply. Professor Crosby's final report has been delayed by considerations which seem to have been beyond his control, but it is hoped that this resurvey of an important district of the State may soon be presented for publication.

INDUSTRIAL GEOLOGY

The plan of including a series of economic minerals in the Museum exhibits was mentioned in the report for the preceding year. Within the past season numerous accessions have been received, as set forth specifically in another place, and such progress made that the successful accomplishment of the plan seems assured. It is not the purpose to present a complete series of ores and economic products but more particularly to display those which typify the State's resources and their relations to industry. There is now in hand a substantial collection that embraces typical examples from the more important mining and quarry localities, besides metallurgical and chemical products of local industry and much illustrative matter bearing upon technical methods of extraction and treatment of minerals.

Mines and quarries. The customary review of the mineral industries for the calendar year was prepared and published in the form of a bulletin. The canvass of the various branches revealed an unprecedented activity in production, although in general the conditions could not be characterized as especially favorable owing to rather low prices. The total value of the output, based on crude or first products, was $41,598,399, the largest that has yet been returned to this office and exceeding the aggregate for the preceding year by about 14 per cent. Clay materials, inclusive of brick, terra cotta, pottery etc., represented a value of $12,077,872, which

was little different from the figure reported for 1912. The stone quarries contributed products valued at $6,763,054. Iron ore, with a gross output of 1,606,196 long tons, had a value of $3,870,841, probably the record production for this industry, as was the total returned for the salt industry which amounted to 10,819,521 barrels valued at $2,856,664. The list of products included over twenty other items. The recent progress of the industries, with notes of new developments or discoveries in the field, are set forth briefly in the report.

Report on quarry materials. The first instalment of a detailed investigation of the quarry materials of the State has been made ready for publication so far as the text is concerned, but the illustrations as yet are not all in hand. The present report deals with the crystalline rocks — the granites, gneisses, trap and marbles — which are represented mainly in the older metamorphic regions; the sandstones and nonmetamorphic limestones of the regularly stratified series still await study.

Iron ores of the Highlands. A brief visit to the iron mines of Orange and Putnam counties for the purpose of securing samples of the ores and containing rocks for the Museum collections has afforded opportunity to make some comparative observations in regard to their geological features. These notes are quite general in character, but they are based on the whole series of ore occurrences, inclusive of practically all that have been commercially worked, and on that account may be of interest. The other recent investigations have been of restricted compass, and in fact there has been no attempt hitherto toward a broad geological study of the ores. The recent papers by C. A. Stewart[1] and F. R. Koeberlein[2] upon some of the Putnam county mines embrace about all that has been done in the field during the last twenty years.

The geological formations of the Highlands of Orange and Putnam counties are part of the long Precambric belt that stretches beyond the limits of New York across northern New Jersey and western Connecticut and that in turn is but a part of the larger Appalachian Precambric province. Throughout their extent from southwest to northeast — along the axis of the belt — they undergo no essential changes of character and continue unbroken into the adjoining states. They form knobs and ridges of greater or less

[1] "The Magnetite Belts of Putnam County, N. Y." The School of Mines Quarterly, April 1908.

[2] "The Brewster Iron-Bearing District of New York." Economic Geology, December 1909.

prominence which are capped by the harder silicate rocks, while the larger valleys are floored by limestones and associated schists.

The main elements in the rock series are gneisses. These show considerable variations in mineralogical composition and appearance from place to place but, broadly viewed, are quite uniform as they consist of certain fairly well-defined types which recur throughout the area. There are dark hornblende gneisses in which the hornblende shares importance with the feldspathic minerals and which are further characterized by the common appearance of epidote as a secondary alteration product. As a rule they are of no great extent in any one section, but reappear frequently in belts or bands within the other gneisses. A lighter variety of gneiss carries hornblende or biotite in subordinate amount, consisting mainly of feldspar and quartz in the proportions found in granites. The feldspar consists of both alkali and calcic varieties. The texture is usually fine granular, revealing little as to the antecedents of the gneiss. The commonest type is banded biotite or hornblende gneiss in which the dark components are segregated in parallel bands with lighter material between. The bands are usually thin and quite regular, lending the appearance of a bedded arrangement. This type resembles the characteristic Fordham gneiss of Westchester county which, as suggested by Berkey, probably continues into the Highlands without interruption. All these rocks contain much igneous material in the form of dikes, stringers and other intruded bodies, or that has been absorbed into the mass in disseminated condition, so that often their aspect is quite as much conditioned by this added material as by the original constituents.

The granitic rocks predominate among the igneous class and are made up of ordinary granites with mica or hornblende as dark minerals, of fine-grained aplitic phases, and of coarser textured varieties classed as pegmatite. The normal granites form bosses and stocks of considerable extent and probably of several different periods of intrusion. The latter inference is based on the varied degrees of regional metamorphism which they exhibit; some are practically unchanged from the condition of their first consolidation and others show granulation, recrystallization, or development of characteristic gneissic appearance. It would seem therefore that at least two periods of intrusion are represented and very likely more. Pegmatite is abundant in the vicinity of most of the mines, and in some cases is closely related to the ore occurrence. It occurs in dikes and lenticular masses, often in thin veins interleaving the gneisses in the same way as the finer grained granite. Its almost

invariable presence in one or both walls of the magnetite bodies is a feature that commands attention and that has been remarked also by Spencer in his work in the New Jersey magnetite districts. The pegmatites are only coarser phases of the normal granites and like them probably are of different ages.

Aside from granite local intrusions of syenitic and dioritic rocks occur in the region. At the Croton mine near Brewster the ore is associated with an augite quartz syenite of greenish color, quite analogous to the augite syenites of the Adirondacks. The last series of intrusions is represented by traps, which occur in small dikes and intersect all the crystalline formations.

Crystalline limestone with interbedded graphitic and pyritic quartzites and mica schists is found in belts that parallel those of the gneisses. The series is very similar to the Grenville limestones and schists of the Adirondacks and, like the latter, has been intruded and metamorphosed by the igneous rocks. Such contact phases carry secondary silicate minerals in greater or less abundance.

The present attitude of the formations is monoclinal — the strike being uniformly northeast and southwest and the dip at a high angle, usually to the northwest. Swings of a few degrees occur in the strike from place to place, and both strike and dip are subject to local undulations as shown particularly in the mine workings. Southeasterly dips have been noted at some of the mines. The ore bodies themselves usually show also a pitch by which the longer axis of the pods and lenses as well as of the minor undulations trend downward toward the northeast.

The magnetite deposits are not limited to any one of the formations which have been named nor to any single set of conditions with respect to them, but have various relations, as will be shown. In composition, they range from lean concentrating ores to those of shipping grade carrying from 55 to 65 per cent iron. They include both pyritous and low-sulphur magnetites and are mostly of rather fine grain.

In perhaps the greater number of localities the ore is associated with the banded gneiss and forms a layer or lens within the latter, itself showing a banded arrangement on the borders by alterations of magnetite and the gneiss. The ore bodies conform to the structure of the gneiss in every particular, following even the minor undulations of dip and strike. They are comparatively thin, seldom over 8 or 10 feet across the dip, but on the other hand very persistent along the outcrop and apparently also in depth so far as they have been tested. A feature of their occurrence in many

places is the zone of dark silicates, particularly of hornblende, which intervenes between the ore and the gneiss. These zones are sometimes composed of hornblende alone, a dark green strongly pleochroic variety, but usually contain more or less quartz and feldspar as well as biotite and magnetite. A conspicuous secondary product is epidote which is rarely absent. Pegmatite may take the place of the hornblende zones along the borders, forming the wall for a greater or less distance. The pegmatite is probably of more than one period of intrusion. For the most part it bounds the deposit without cutting or affecting in any way the magnetite; but in a few places there is pegmatite that seems to be later than the ore, as instanced in some Putnam county mines that are mentioned by Stewart in the paper already quoted.

A modification of this type of occurrence is illustrated by those deposits in which pegmatite is in direct contact with the magnetite on one or both walls throughout its extent, although the general country rock is gneiss or mixed gneiss and pegmatite. Under this condition the magnetites are more coarsely textured and lack the layered arrangement characteristic of the bodies bordered by gneiss alone. In the Forest of Dean mine, which is the principal example of this type, the magnetite forms a long pod in contrast with the simple tabular form of the deposits already described. The cross-section of this body is heart-shaped, the two lobes somewhat drawn out and directed upward following the steep dip of the country gneiss. The pitch is 20° northeast. The ore is of shotlike texture and maintains a uniform percentage of iron so as to be practically all of shipping grade. The two lobes are separated by a horse of pegmatitic granite which extends from the surface to the bottom of the workings now 3000 feet on the incline. The same rock is also seen along the border of the main ore mass in many places, and inclusions of it are found in the ore itself. So far as the writer has been able to learn there is no evidence to connect the latter with dike intrusions; rather they appear to be floating masses with the ore.

A third class consists of disseminated magnetites within pegmatitic granite. The ore is a mixture of coarse crystalline magnetite with the ordinary pegmatite minerals and may carry from a few per cent to 40 per cent of iron. These bodies of course have no particular shape or trend of themselves but depend on the local development of the pegmatite mass which may take the form of a lens, a dike or a rounded bosslike body in the gneiss. They are free of pyrite and afford an ore easy to concentrate, although they

are not often very large. They appear to be more common across the line in New Jersey than in the New York Highlands. One mass just south of the town of Warwick can be traced for a long distance but is very irregular, pinching in places to a thin film and again bulging out into a body 100 feet or more across. There seems no reason to regard the magnetite as other than an original constituent of the pegmatite matrix and thus probably of deep-seated origin.

A fourth type, illustrated by a single occurrence to the writer's knowledge, is the Croton deposit in which the magnetite is included within augite syenite. This occurrence has been described in considerable detail by Koeberlein, and the present writer's observations agree with his conclusions. The ore is a mixture of magnetite with the minerals of the syenite which are mainly feldspar and pyroxene, but contains besides more or less quartz, biotite, hornblende, apatite and sulphides. A peculiarity of the ore in this section is the rim of titanite which surrounds the magnetite grains. The magnetite has crystallized after the silicates, in the reverse order of its consolidation in the igneous rocks which have low percentages of the mineral — an anomaly that has been frequently noticed in the disseminated ores of this type. The ore body grades off at the edges into the normal syenite. If the wall rock is igneous, as is indicated by its mineralogy and texture and also by its analogy with the augite syenites of the Adirondacks, the ore is doubtless a magmatic segregation in place.

Another class of deposits differs from all the foregoing in that the limestone forms one of the walls. The ore lies near the contact also with granite or gneiss. The matrix consists of calcite and silicate minerals like pyroxene, amphibole, garnet, chondrodite, chlorite and serpentine. Spinel also may be present. The limestone contact is usually marked by aggregates of the silicate minerals which resemble the skam zones of some of the central Sweden mines. The magnetite is rather fine in grain and on account of the intricate admixture very hard and tough. Analyses show small amounts of manganese. The shape of the ore body is more irregular than that of the deposits in gneiss, only roughly approaching a lenticular or tabular form. The silicate zones evidently are the result of contact influence upon the limestone exerted by igneous masses. The direct agent of metamorphism no doubt is granite or its pegmatite derivative since the rock is always close at hand and of the igneous representatives is the most efficient in producing contact alteration. The best known locality for magnetites of this class is the Tilly Foster mine in Putnam county which has been

repeatedly described so that it has become familiar to students of ore deposits and has been considered almost unique in this part of the country. The writer has found, however, a group of deposits in Orange county, which embody the same features, inclusive of the occurrence of chondrodite, spinel and other contact minerals. This group includes the O'Neill, Forshee and Mount Basha (Mombasha) mines, south of Monroe. In thin sections of the ore from the O'Neill mine both chondrodite and humite were identified. The magnetite is distributed in grains and granular aggregates which often surround the particles of silicates and evidently have crystallized in close relation with them. It seems reasonable to suppose that the iron has been deposited along with the silicates and as a result of the same process, that is by the influence of the heated solutions and vapors given off by the granite magma.

Mineralogy. The principal sources from which the mineral collections of the New York State Museum are derived are as follows:

1 *The Beck collection.* This comprises a considerable portion of the mineralogic material of the State Geological Survey prior to 1842. It was probably the material collected by Dr L. C. Beck for the Report on the Mineralogy of New York.

2 *The Brazilian collection.* This consisted of a small collection of Brazilian minerals and ores, presented in 1865 by the National Museum of Rio de Janeiro, through the Hon. Mr Lisboa, Envoy Extraordinary of Brazil. The present labels on the displayed specimens are inscribed: Presented by Univ. Rio de Janeiro.

3 *The Pickett collection.* This collection consisted principally of fossils but contained some minerals, principally from Lockport and from the New England localities. It was purchased in 1867 from the heirs of the late Professor Pickett of Rochester. The material of this collection is below the grade of the present collections and is poorly represented in the present installation.

4 *The Emmons collection.* This collection was acquired in 1870 through the gift of the Hon. Erastus Corning, who purchased it from the family of the late Dr Ebenezer Emmons. The collection consists largely of crystallized specimens of New York minerals and of foreign occurrences; among the former is a magnificent suite of calcite from the Rossie, N. Y., locality and among the latter a series of specimens from the Hartz, Saxony localities which bear the label of the Freiburg Mining School with the date 1848. The present labels on displayed specimens are inscribed: Presented by Hon. Erastus Corning.

5 *The Simms collection.* A collection consisting principally of gold and silver coins and historical relics, but which included some mineral specimens, was purchased in 1870 from Mr Jeptha Simms of Fort Plain. Few of the mineral specimens in this collection are up to the grade of the present installation.

6 *The Gebhard collection.* This collection was purchased in 1872 from the late John Gebhard, of Schoharie county. The collection, although including some foreign occurrences, was mainly confined to Schoharie county minerals. It is not represented to any considerable degree in the present installation.

7 *The Kunz collections.* These include a fine and extensive general mineral collection purchased from Dr George F. Kunz of New York City in 1886 and a smaller but important collection of minerals from New York City and from Westchester county, N. Y., which was purchased from Doctor Kunz in 1888. The former of these comprises the basis of the present installation of the general mineral collection as well as the bulk of the gem collection. The latter represents a considerable percentage of the present installation of the New York State collection.

8 *The Albany Institute collection.* This collection, which was presented in 1891 by the Albany Institute, includes specimens of great historic value as well as many of intrinsic worth as measured by the standards of the present installation. Among the contributors of specimens to this collection are to be found such names as: Stephen Van Rensselaer, DeWitt Clinton, T. Romeyn Beck, John Gebhard, L. C. Beck, Erastus Corning etc. The present labels on the displayed specimens are inscribed: Presented by the Albany Institute.

9 *The Clark collection.* A small but locally important collection of the minerals of Rondout was presented in 1904 by Mr P. E. Clark of Rondout. The residue of Mr Clark's collection was subsequently purchased the same year and the whole constitutes a suite from which many fine specimens contained in the New York collection have been drawn. A large proportion of these bear the label inscription: Presented by P. E. Clark.

10 *The Nims collection.* This embraces the remainder of the mineral material collected by the late Mr C. D. Nims of Philadelphia, N. Y., which was purchased in 1908 from his son, Mr A. T. Nims of the same place. The Nims collection, while containing some foreign and United States specimens acquired by the elder Nims in exchange, is specially rich in occurrences from northern New York and Canada and notably in those from St Lawrence

county, N. Y. A very appreciable percentage of the present installation of the New York State collection is representative of this material.

11 *The Hodge collection.* This collection was purchased in 1909 from Mr R. S. Hodge of Antwerp, N. Y. It represents the mineral specimens collected by Mr Hodge from the Sterling mine at Antwerp during the many years in which he was superintendent of that mine, and is consequently unquestionably the best representation of the minerals of this famous and unique locality.

12 *The Young collection.* The collection of the late Dr Silas Young of Warwick, N. Y., was purchased in 1914 from Miss Jennie Young of Warwick. The Young collection represents the life efforts of an enthusiastic, accomplished and industrious collector working in the rich field of Orange county, N. Y., and northern New Jersey. The extra local material of the collection also bears witness of the keen appreciation of mineral values which Doctor Young exercised in effecting exchanges.

The present installation of the general mineral collection is made up as follows:

	Per cent
Kunz Collection	54
Young Collection	5
Brazilian Collection	½
Pickett Collection	½
Emmons Collection	2
Albany Institute Collection	2
Gebhard Collection	½
Other sources	35½

The present installation of the New York State mineral collection is made up as follows:

	Per cent
Kunz Collection	13
Beck Collection	10
Emmons Collection	1½
Young Collection	6
Nims Collection	5½
Hodge Collection	3
Clark Collection	3
Pickett Collection	1
Collected by the Mineralogist	11½
Other sources	45½

V

REPORT OF THE STATE BOTANIST

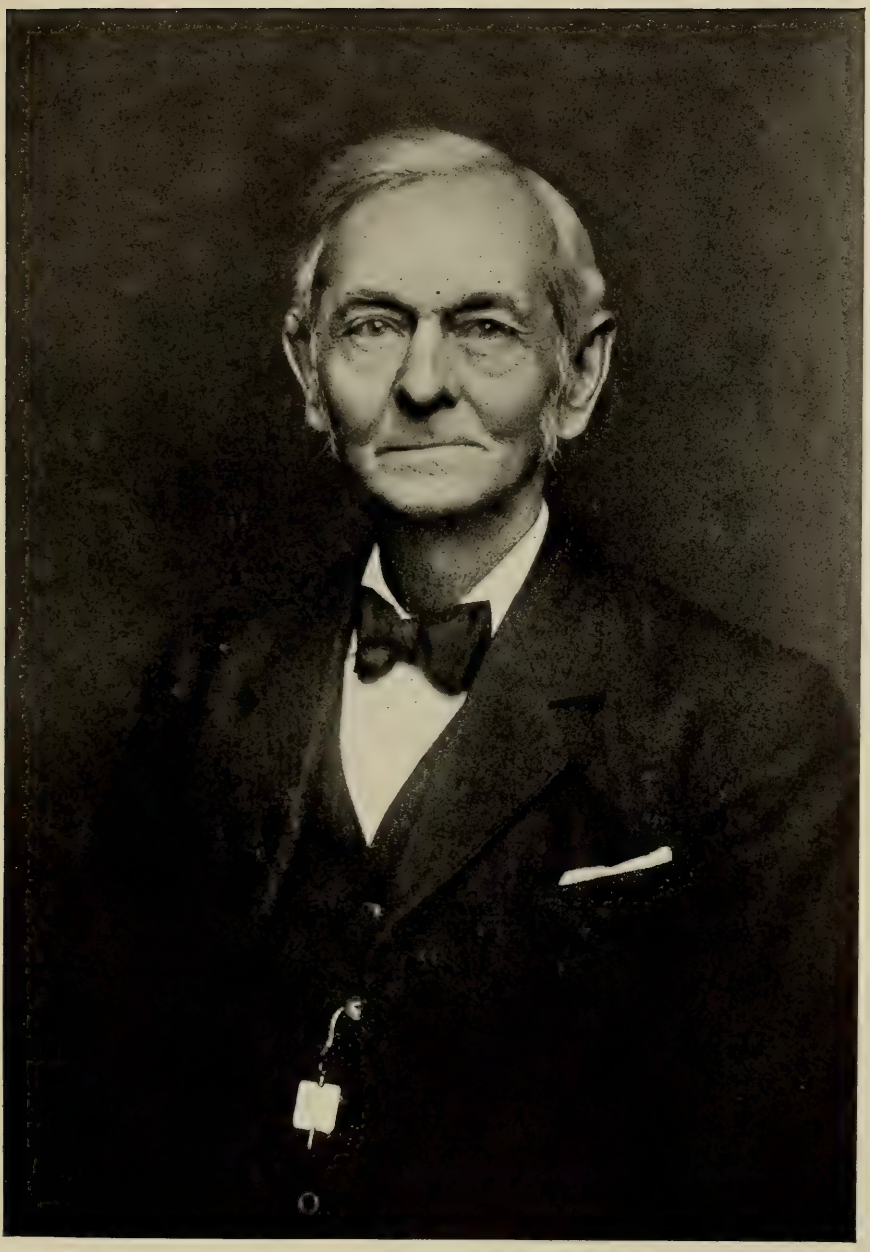
Resignation of Dr Charles Horton Peck, State Botanist. Because of advancing years and impaired health, Doctor Peck has resigned from the scientific service and in accepting his resignation the Regents of the University spread upon their records the following minute:

The service rendered to the State by Charles Horton Peck D.Sc., who has just retired from his position as State Botanist, has been extraordinary in its fidelity, assiduity and productiveness. Doctor Peck entered the staff of the State Museum as botanist in 1867, and from that date to the present his service has been continuous — a period of 48 years. In 1883 the position of State Botanist was created and he has been its only incumbent.

The nearly half century of his scientific activity became an epoch in the science of botany in America, by virtue of the extensive contributions which he made, not alone to the knowledge of the flora of New York but specially through his almost pioneer investigations among the fungi. His researches in this field vastly increased the sum of knowledge and established an orderly and rational classification so that his published papers, issued in the reports of the State Museum, are indispensable to any student of these forms of life. The number of species discovered and described by him are counted by thousands and the additions made through his efforts to the State herbarium are so extensive that this collection of plants is today among the largest on the continent and of great scientific worth. By common consent of his colleagues Doctor Peck has long been recognized as the ultimate authority in mycology — the field of his special labors.

In view of these services whose value to the State can not be briefly estimated or readily expressed, the Regents take this occasion to record, with their regret that the exactions of time have impelled him to retire from the service of the University and the State, their congratulations to Doctor Peck upon a life well rounded and work well done, with their assurance of continued interest and deep regard for his welfare during the years that may remain.

In view of the resignation of Doctor Peck, Doctor Homer D. House has been appointed Acting State Botanist until such time as the Civil Service Commission shall determine the status of the position.



CHARLES HORTON PECK

New York State Botanist 1867–1915

Noteworthy contributions. The most important addition to the State herbarium during the past year is the gift by Prof. Charles S. Sheldon of Oswego, of his entire herbarium, numbering over 14,000 mounted specimens, in addition to a large quantity of duplicates and unmounted material. Professor Sheldon's herbarium contains collections from every state of the union, Canada, Mexico and several European countries. The New York State collections, made chiefly by Professor Sheldon between 1877 and 1895, alone number 1020 specimens. A more detailed account of this collection will be found in the separate report of the Botanist.

Mr Simon Davis of Brookline, Mass., has presented a collection of 60 species of fungi native of the eastern United States. A large number of interesting flowering plants and fungi have been received from Dr W. Haydon, of Marshfield, Ore.

Scientific investigations. The limited amount of time available for field work was spent chiefly in a reconnaissance of the vegetation and its ecological relations, about the eastern end of Oneida lake, a region of extensive sandy barrens, swamps and bogs, in addition to the interesting vegetation of the shores and shallow waters. This study will be brought to a close during the coming season. Observations were also made upon the vegetation of several of the sphagnum bogs of central New York and it is to be hoped that these observations may be brought together in a formal way at some future time. New localities for certain rare species are reported under "Notes on Local Floras."

Exchanges. It has been found desirable to distribute as exchanges many of the duplicate fungi and flowering plants of the herbarium, thus enriching our collections and making available much valuable space heretofore occupied by the stored material. Exchanges have been effected with Mr G. Newodowski of Kiev, Russia, from whom the herbarium has received a valuable collection of fungi, chiefly parasitic leaf forms, native of eastern Europe and the Russian Caucasus. From Brother Victorin, of Longueuil, Quebec, has been received in exchange a large collection of flowering plants representing the flora of our northern border.

Condition of the collections. Further progress has been made in the arrangement of the collections which, with minor exceptions, are now in permanent form. Although there is on hand considerable material, stored away in more or less inaccessible bundles, practically all the valuable material has now been labeled and placed in proper sequence in the herbarium and thus made available for study. This

has resulted in a great increase in the value of the herbarium for purposes of scientific research and is correspondingly appreciable to the numerous botanists who have had occasion to consult the collections during the past year.

Additions to the herbarium. The number of specimens of New York State species which have been added to the herbarium from current collections during the past year is 675, from contributions 336, from the Sheldon herbarium 1020, a total of 2031 specimens. Of this number, 75 species are new to the herbarium and 4 species are believed to be new to science. The extralimital specimens of the Sheldon herbarium number 13,382.

The number of those who have contributed specimens is 33. This includes those who have sent specimens merely for identification, which were desirable additions to the herbarium.

The current collections of the staff were made in the counties of Albany, Fulton, Madison, Oneida, Onondaga, Oswego, Rensselaer and Ulster. The specimens contributed are from the counties of Albany, Cayuga, Chemung, Dutchess, Erie, Franklin, Herkimer, Livingston, Madison, Monroe, Oneida, Onondaga, Oswego, Putnam, Rensselaer, Schoharie, St Lawrence, Tompkins, Washington and Wayne (including the New York plants of the Sheldon herbarium). The extralimital specimens contributed were from Arizona, California, District of Columbia, Illinois, Massachusetts, New Jersey, Oregon, South Carolina, Washington, Wyoming and Vermont; Ontario, Quebec and Russia.

Identifications. The number of identifications made of specimens sent or brought to the office by inquirers is 556. The number of persons for whom these identifications were made was 151.

VI

REPORT OF THE STATE ENTOMOLOGIST

The State Entomologist reports regarding insect depredations a continuance of the extended injuries by the apple tent caterpillar and the forest tent caterpillar. The work of the latter species was particularly evident on Long Island and in the Adirondacks. Popular warning notices were sent early to the press, and at Westbury and Elizabethtown, power spraying outfits were used most successfully against the forest tent caterpillar. The ten-lined inch worm was locally abundant in the Catskills and Washington county.

More detailed accounts of the subjects discussed in this chapter appear in the annual report of the State Entomologist.

Oil injuries. The serious results following the application of petroleum compounds to the bark of dormant trees have again come under observation. One of the most interesting of these cases was at Dalton, Mass., and resulted from the application in May 1913 of burlap strips soaked in lubricating oil to sugar maple trees planted some ten or eleven years previously. The Entomologist also examined a number of fruit trees in widely separated orchards where conditions favored the belief that the serious injury to the trees was due to an earlier application of a miscible oil.

Fruit tree pests. Studies of the parasitic enemies of the San José scale, begun in 1913, have been continued. This work has resulted in the finding of a number of orchards where these beneficial forms were abundant and apparently very effective agents in checking the pest. The most efficient species is the recently discovered and newly characterized Prospaltella perniciosi Tower, a form which is widely distributed in certain sections of the State, at least. In spite of the abundance of these natural enemies, it is believed that, as a rule, fruit growers must continue to rely upon the application of lime-sulphur washes for the control of this scale insect.

Field studies of *red bug* injury have shown that in the Hudson valley, at least, the lined red bug, Lygidea mendax Reut., is the species responsible for most of the damage to the fruit. Practical work in orchards indicates that a nicotine preparation such as "black leaf 40" is one of the most effective sprays. It is probable, in the case of badly infested trees, that a special application of nicotine and soap must be made somewhat later than it would be safe to use the lime-sulphur wash at winter strength.

The *pear thrips,* as shown by investigations of the last season, continues to be a serious pest of the grower in the Hudson valley, appearing here and there in a most erratic manner and injuring Seckel and Bartlett trees in particular. It was found that orchards practically free from the pest one season may be seriously affected the next. A detailed account of this insect has been given in the Entomologist's report for 1912. In at least one case pear midge injury, supplementing the damage caused by the thrips, resulted in an almost total loss of the crop.

The *pear psylla* has continued a serious enemy of the grower, being particularly abundant and injurious in certain extensive orchards in the vicinity of Milton and Marlboro. The practical value of late spring applications of a lime-sulphur wash for the control of this insect, was demonstrated earlier, and observations in these orchards showed the necessity of carefully eliminating artificial shelters, such as stone walls, brush heaps and even check trees, if the best results are to be secured.

The *banded grape bug,* Paracalacoris scrupeus Say, noticed in detail in the Entomologist's report for 1913, has continued its injurious work. Through the cooperation of Mr L. F. Strickland of the State Department of Agriculture a series of nymphs were received and detailed descriptions of the early stages have been drafted and are included in the report for the present year.

Gipsy moth. One of the worst infestations of the gipsy moth yet discovered in the State was located by the Entomologist last spring, with the cooperation of Mr F. A. Bartlett, at Mount Kisco. The infestation was of several years' standing and a few egg masses were found at a considerable distance from the center of the colony. Prompt and vigorous action by agents of the Department of Agriculture has resulted in nearly exterminating this menace, and it is most earnestly hoped that in another year or two this outlying colony will be entirely destroyed.

Brown-tail moth. A scattering infestation of the brown-tail moth was discovered early in the year on Fisher's island and the eastern end of Long Island. The pest very probably drifted with the winds from the adjacent infested mainland of Connecticut. Systematic scouting and the destruction of overwinter nests, by agents of the State Department of Agriculture and the Federal Government, have prevented extended multiplication the past season. The abundance of oaks on Long Island renders it very probable that this pest will breed freely in that section unless checked artificially. The prevalence of this insect in large numbers would

mean an inevitable drop in the prevailing high land values. The Entomologist, cooperating with other local and State agencies, is endeavoring to arouse a general interest in the control of this insect while the infestation is still in an incipient stage.

Grass and grain pests. There was an extended and serious outbreak of grasshoppers on the border of the Adirondacks, portions of Fulton, Saratoga and Warren counties, in particular, suffering greatly. Warning notices were issued, giving directions for checking the pests before the situation became serious, and later at the request of the Governor, a special study of the problem was made and, in cooperation with agents of the State Department of Agriculture, a most satisfactory demonstration of the efficiency of poisoned baits was conducted. The grasshoppers of the State have been carefully studied in this connection, and a detailed account of these insects, their capacity for harm and control measures is given in the Entomologist's report.

There were numerous local and, in some instances, severe injuries by *army worms* in mid July and early August. Newspaper bulletins giving full information respecting this insect and methods of control were issued at the inception of the attack. These outbreaks invariably arouse considerable apprehension because of the masses of caterpillars, though as a rule the damage is restricted to comparatively small areas. The work of the past season demonstrated the utility of poisoned baits similar to those employed against grasshoppers.

Studies of *white grubs* and *June beetles,* begun in 1912, were continued, one of the most interesting developments being the rearing of a number of a rather scarce robber fly, P r o m a c h u s f i t c h i i O. S., and the large, white maggots observed in association with and preying upon white grubs during both 1912 and 1913. Observations were also made upon the numbers of and injuries by the beetles, and later in the season upon the abundance of the small, white grubs, which latter, when numerous, invariably cause serious damage the following season. Local conditions were characterized in brief, practical accounts being sent to papers circulating in section where the pests were most abundant. Grass webworms, prevalent and injurious in a number of cornfields in Dutchess county, were investigated. Control measures, as has been demonstrated by earlier work, must be restricted largely to planting immune crops on badly infested land. These small insects are by preference grass feeders and, under normal conditions, may become exceedingly numerous on land allowed to lie in grass for a series

of years. An interesting and rare type of injury was observed in one of the infested fields. It was caused by a small, yellow field ant, probably Solenopsis debilis Mayr., eating out the contents of the kernel, and the corn sprout, thus deprived of its normal nourishment, developed very slowly.

Shade tree insects. Injuries by the elm leaf beetle continue as in previous years, though local restrictions were perhaps fully as marked as in earlier seasons. There was a great decrease in this pest in 1912, due, as the Entomologist then believed, to abnormally low temperatures in mid June, and the same phenomenon, though to a somewhat less extent, was observed last season. A study of the abundance of this insect in connection with the temperature records for the past decade has enabled the Entomologist to formulate a provisional rule as to the relation existing between the abundance of the beetle and low temperatures in mid June.

The *spruce bud scale,* Physokermes piceae Schr., a comparatively unknown pest in New York State, has been brought to our attention during the last two or three years from widely separated localities, and a study of the situation indicates a connection between infestation by this scale insect and the dying branches so frequently seen upon Norway spruce trees.

The Norway maple, hitherto regarded as comparatively free from insect pests, has been shown by the studies of the past season, to be subject to attack by a leaf hopper, Alebra albostriella Fall., and a scale insect, Leucaspis japonica Ckll. The former appears to be very serious at times, and the latter may prove to be a species of considerable economic importance.

Forest pests. The hickory bark beetle still continues as an important pest in the vicinity of New York City and here and there in the Hudson valley, though from the investigations the injury does not appear to be so extensive and severe as in earlier years. It is to be expected that natural enemies will soon begin to regain the ascendency, which already seems to be the case to a limited extent. It is undoubtedly true that conditions have been materially benefited by the somewhat general cutting and burning of badly infested trees.

The establishment of the recently introduced *bayonet* or *posthorn pine* borer, Evetria buoliana Schiff., in several New York localities, was investigated. This introduction adds another potentially important enemy to our list of pine pests. This European species has evidently been established in the country for several years, probably being brought here with nursery stock. The in-

festation is at present so limited that there is a possibility of exterminating the borer.

The *maple and oak pruner,* a rather common enemy of oaks, in particular, has been unusually abundant and injurious, especially in the lower Hudson valley and, as a consequence, many inquiries have been received concerning this insect and methods of control.

The large *European hornet,* Vespa crabro Linn., became established in this country several years ago, and during the last year or two has attracted notice by its habit of removing the bark from small, living twigs or branches, birches suffering in particular. Ordinarily this damage does not amount to much, though it might be considered serious in the case of specimen trees or shrubs on lawns.

Garden and greenhouse pests. The large, brilliantly colored Say's *blister beetle,* Pomphopoea sayi Lec., has again attracted notice because of its unusual abundance in various localities in the State. A brief warning notice was issued. One of the noteworthy features of the outbreak was the threatened destruction of the yield from an acre of beans.

Another unusual outbreak was that of the *Juniper plant bug,* Chlorochroa uhleri Stal., a stout, greenish, pink-margined stink bug which became excessively abundant and injurious at Quaker Street, Schenectady county. These bugs, ordinarily rare, were so numerous as to destroy many of the young peas while still in the pod and seriously affect the yield of several garden crops. A study of this insect was made in connection with the outbreak.

The orchid Isosoma, I. orchidearum Westw., is rarely brought to the attention of the economic entomologist, partly because of its scarcity and probably also on account of the fact that orchid growing is a highly specialized and therefore fairly well understood business. Pseudobulbs of orchids infested with this insect were received from Mount Kisco last July, and later in the season orchid roots infested with the Cattleya midge, Paralellodiplosis cattleyae Moll., were transmitted by another person. Both of these insects affect the vitality of the plants.

Flies and mosquitos. The interest in the control of the house fly has continued, and early in the season the Entomologist prepared a brief folder concerning the house fly. This was widely circulated in a monthly bulletin of the State Department of Health, and also issued separately.

Practical control of mosquitos has received its due share of attention, the Entomologist personally investigating a peculiar problem

on the shores of Sodus bay. The investigation started the past season will be continued another year in an attempt to abate the mosquito plague associated with swamps lying practically at lake level.

Gall midges. The European box leaf miner, Monarthropalpus buxi Lab., has become well established on Long Island and is seriously injuring box hedges, since many badly infested leaves drop and the plants soon become very scraggy. A series of experiments has shown the practicability of destroying these miners while still within the plant, by the use of fumigants, carbon bisulphide being the most promising.

Studies in this group (Itonididae) have been continued, and a number of new species, mostly reared, and several new genera described. There have been a number of important additions in this group to the New York fauna. The American zoophagous species, mostly beneficial because of their preying upon other forms, especially scale insects, plant lice and plant mites, have been tabulated. This compilation shows a possible importance as natural checks heretofore scarcely suspected.

Lectures. The Entomologist has delivered a number of lectures upon insects, mostly economic forms, before various agricultural and horticultural gatherings, some of them being in cooperation with the Bureau of Farmers Institutes or county farm bureau agents. Several lectures have also been given under the auspices of local improvement associations.

Publications. A number of brief, popular accounts regarding such common pests as the house fly, apple and forest tent caterpillars, the elm leaf beetle and June beetles, have been widely circulated through the press. The more important publications of the year are "The Gall Midge Fauna of New England," and several papers describing new genera and species of gall midges.

Faunal studies. The investigations of earlier years along these lines have been continued, and there is now in manuscript a list of the insects of the Adirondack region, based mostly upon material in the State collections. There was some special collecting in the Adirondacks in connection with the investigation of grasshoppers noted above, and Assistant State Entomologist Young continued his studies of the fauna at Wells, paying special attention to the hitherto largely neglected Mycetophilidae, and obtaining a number of new species and also of known forms not previously recorded from the State.

Collections. A large series of insects was obtained by purchase from the Kny-Scheerer Company of New York. These are for the exhibit collection now being prepared and were selected primarily because of their value in supplementing or elucidating the material already at hand. The similarities obtaining among insects in different sections of the world, the remarkable developments in certain highly specialized forms, and the enormous size of some species are well illustrated in these recent acquisitions.

Through exchange with Mr C. W. Johnson of the Boston Museum of Natural History, the Museum has acquired a series of 83 species (listed elsewhere) of two-winged flies, mostly unrepresented in the collections. These being determined by a well-known authority in the group, constitute a notable addition to the State collections.

The entomological division has received, through exchange, from Prof. S. I. Kuwana of the Board of Plant Inspection, Imperial Ministry of Agriculture and Commerce, Tokio, Japan, specimens of 30 species of Coccidae, a number of them representing species described by Professor Kuwana and therefore particularly desirable.

Accessions such as those mentioned above add greatly to the value of the State collections, especially when the group is economically important, as is the case with the Coccidae or scale insects. There have been numerous additions during recent years in this family. There are now in the collections 181 species, 72 of which have been mounted on microscopic slides, 4 being represented only by such preparations. There are 41 species from Japan, 28 from California, 7 from the Philippine Islands, and 9 types and 7 cotypes. This assemblage is a most valuable aid in determining the scale insects so frequently submitted for name. The Coccidae are so readily transported with nursery stock that species of extralimital forms are very desirable. Only last summer there was found on Norway maple, a Japanese species which may prove of considerable economic importance.

Additions are constantly being made to the State collections, especially of specimens representing the early stages and work of various injurious forms, since biological material of this character greatly facilitates identification of the different insects and is indispensable in a well-prepared exhibit illustrating the life histories of different species. The State collection now contains a large amount of material which is invaluable because of the associated data. Many microscopic preparations of smaller insects have been made and incorporated in the collections as in earlier years.

The arrangement and classification of the collections require a large amount of time. The many additions must be interpolated and there are numerous groups still far from being thoroughly classified. The large series of Lachnosterna captured during the past summer were determined by Mr Young. The collection of grasshoppers taken in connection with the grasshopper investigations referred to above, necessitated the rearrangement of the Orthoptera.

Nursery inspection. The nursery inspection work of the State Department of Agriculture results in numerous specimens representing any stage in insect development, some in very poor condition, being submitted for identification. As such material may originate in a foreign country, determinations of this character are laborious and require for their successful prosecution a large collection and an excellent library of both domestic and foreign works. The correct identification of such material is very important, since the disposal of entire shipments of nursery stock must depend in considerable measure upon the character of the infestation.

General. The work of the office has been materially aided, as in past years, by the identification of a number of species through the courtesy of Dr L. O. Howard, chief of the Bureau of Entomology, United States Department of Agriculture, and his associates. A number of correspondents have donated valuable specimens, listed elsewhere, and many have rendered efficient service by transmitting local data respecting various insects. There has been as in the past, a most helpful cooperation on the part of all interested in the work of the office.

VII

REPORT ON THE DIVISION OF ZOOLOGY

In the zoological section of the Museum substantial progress has been made, although from the nature of the work to be done, this section has been more affected than some of the others by the small amount of technical and expert assistance that it has been possible to provide. Temporary arrangements and expedients have been avoided as much as practicable, and the work that has been done has been carried out with a regard for the permanence and future growth of the exhibit, so that it will not have to be done over again.

Owing to the slow progress in installing the exhibition cases in the zoology hall and preparing the room for occupancy, the work of arranging the specimens in the cases could not begin much before the end of December, but has been continued steadily since that time, and by the end of the fiscal year many of the cases were completely or nearly completely filled and arranged, and most of the others had received a considerable part of the material which it is planned to exhibit in them. Those reserved for invertebrates, and a few of the large group cases, still remained empty, but the work was far enough advanced to make the collection well worth a visit from those with even a small interest in zoology or nature study, and to require only the finishing of several of the large mammal groups to remove most of the appearance of emptiness and incompleteness which the room still presented.

The large and handsome series of *domestic fowls,* donated by the New York State Agricultural Society but never properly displayed in the old building, has been installed, and forms one of the most instructive and attractive features of the Museum. It occupies a series of alcove cases extending along nearly the entire east side of the room. In a corresponding position on the west side the *wild birds* of the State have been installed, but in this collection a number of species are still wanting or represented only by inferior specimens. These deficiencies are being filled as fast as the required specimens can be obtained. The systematic collection of the *eggs* of the New York State birds has been displayed in a series of inclined-topped cases adjacent to those containing the birds. The sets of eggs are shown in black cardboard trays containing blackened sand or sawdust, which sets off the colors and markings of the specimens in a very attractive manner. This collection is, however,

by no means as complete as it should be, as even many of the commoner kinds are insufficiently represented or wanting entirely, and additions to the series are very much desired.

The Museum's collection of *birds' nests* is only a very small one, but most of them have been put on exhibition, the smaller ones in the cases with the birds to which they belong. The nests of most of the larger birds are too bulky to be provided for in this way, but in many cases special groups consisting of the nest, parent birds and young or eggs have been planned, and much material for such groups already acquired. Other series of specimens which have been partly installed are the *mammals,* in which the Museum is still unfortunately quite deficient; the *reptiles* and *amphibians,* which are shown mainly by casts and mounted specimens, avoiding the unsightly and discolored alcoholic material commonly used; and the skeletons. The *fishes* of New York have been put in order and are now nearly all mounted in the cases along the corridors of the rotunda. Work on the large groups in the central part of the room has progressed favorably. The *puma* group is completed and the *moose* and *buffalo* groups far advanced toward completion. A large group of *whistling swans* promised by a friend of the Museum, is said to be approaching completion, though it had not yet been delivered when the year came to a close.

Accessions to the collections of considerable importance have been made during the year. The most important addition is a large series of native birds and mounted fishes deposited by the Conservation Commission. The fishes were an especially welcome accession, comprising over one hundred examples of the principal native game and market fishes, most of them unusually large and fine specimens, and well mounted. This collection was brought together by Dr Tarleton H. Bean, the State Fish Culturist. Other important accessions are a series of mounted birds of species native of New York purchased from Mr Fred Barker of Parker's Prairie, Minn., and some exceptionally fine wax casts of amphibians, chiefly frogs and salamanders, made by Mr Dwight Franklin, who has done much work of a similar character for the American Museum of Natural History. The skeleton of a right whale has been acquired and will presently be mounted, and a collection of the principal breeds of domestic pigeons to supplement the series of domestic fowls which the Museum already possesses.

VIII

REPORT ON THE DIVISION OF ARCHEOLOGY AND ETHNOLOGY

During the fiscal year much of the work of the archeology division has been the sorting, cataloging and classifying the thousands of specimens. Within the year more than 15,000 specimens have been added to the collections making, with those reported last year, a total of over 30,000. There are many duplicates of the more ordinary objects, such as stone knives and net sinkers, but from the various collections it has been possible to select a remarkable series of objects illustrating the facts of New York archeology.

There has been some necessary delay in the matter of getting the cases properly placed, due to the separation of the archeological and ethnological exhibits.

The largest collections obtained during the year are those of Prof. D. F. Thompson, Otis M. Bigelow and L. D. Shoemaker. These collections are from three archeologically important regions in New York, the upper Hudson, central New York (Onondaga-Seneca river) and the headwaters of the Susquehanna.

THE NEW COLLECTIONS

The Museum has continued its plan of acquiring large collections representing special areas within the State. During the past two years forty or fifty collections have been examined and studied. Of this number, ten collections were selected last year. Within the year just closing ten more have been obtained. Not all this material is for exhibition purposes, the greatest quantity being reserved for study and comparison. Every scientific museum must have an abundance of material in its unexhibited "duplicate" collections. There are, on the other hand, thousands of specimens that are specially suited for exhibition in the cases of the Museum and these have been carefully selected for this purpose.

Among the principal collections or lots, acquired during the year are the following:

By purchase

From L. D. Shoemaker, Elmira	1 250
Dwinel F. Thompson, Troy	3 500
Otis M. Bigelow, Baldwinsville	10 000
E. R. Burmaster, Irving	126
Smaller collections	50

By collection

From D. D. Luther, Naples	47
A. C. Parker, Albany	36

By donation

From W. D. Gebhard, Schoharie	27
Walter Hutchins, Albany	415
E. Reinhard, Buffalo	88
	15 539

It will be observed that these collections have come from several important localities not heretofore well represented in the State Museum archeological collections.

The collection made by Mr L. D. Shoemaker of Elmira is an admirable example of a well-arranged collection of surface finds. Each specimen is numbered and cataloged and a map and description of the localities accompany it. Its value lies in the fact that it delineates the archeology of the valleys of the Susquehanna, Chemung and Tioga. These localities were the routes of many wandering bands of aborigines from early times, and continued so as long as there were Indians situated on or near those several waterways.

By far the most important collection obtained is that brought together by Mr Otis M. Bigelow of Baldwinsville. It was not originally amassed with any special scientific intent but, seemingly, merely as a collection of Indian "relics." No special pains were taken to make a scientific catalog or to chart the sites from which the various objects came, but Mr Bigelow, before turning the collection into the Museum, made an effort to classify the localities and give a correct record of each object. All the principal specimens have full data accompanying them and thus much may be learned of archeologic importance.

The collection obtained from Prof. Dwinel F. Thompson of Troy consists mostly of objects acquired in the territory in and adjacent to the upper Hudson valley. There are also many good specimens from the Mohawk and from the Genesee valleys. Professor Thompson made his collection in a systematic manner and kept a careful record of all his specimens. Every article has an index number and a locality mark, both neatly applied.

The Bigelow collection. This represents the efforts of the collector during the past fifty-five years to gather representative

Monitor pipes and copper objects from New York

Tubes and pipes from Mound Builder sites in New York

material from the region about the Seneca river, Onondaga lake, Oneida lake and the hilly ground south of Syracuse. A field examination of this area shows it to have supported large populations of the aborigines for lengthy periods and evidently from remote times. Several considerations undoubtedly attracted these early inhabitants, among them the accessibility of the various portions of the surrounding country by means of lakes and streams, the abundance of fish and game, and the rich soil for agricultural purposes. Thus the larger number of specimens in the Bigelow collection consists of hunting, agricultural and domestic objects.

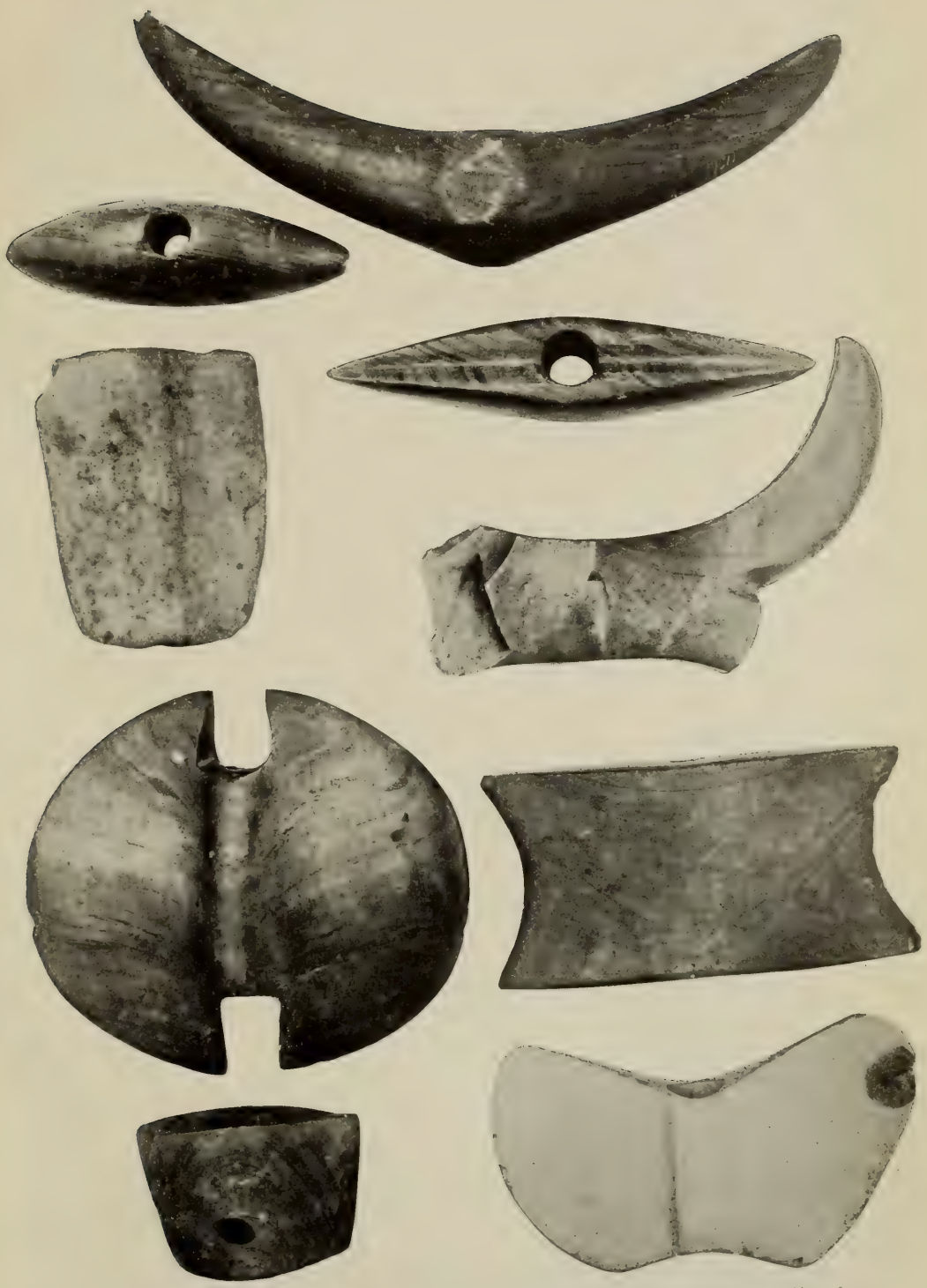
Four distinct cultures are represented in this collection, that termed the Eskimoan, characterized by slate knives and semicircular chopping knives, etc; the early Algonkian; the Mound Builder, and the Iroquoian. For the sake of convenience, it is better to term these occupations as pre-Iroquoian and Iroquoian. Most of the material consists of stone objects, in which class the chipped chert implements lead in numbers. Then follow the polished stone implements, principally chisels, gouges and stone axes or celts. There is also a small series of stone pipes. Among the objects having no known utilitarian purpose are gorgets, banner stones, boat stones, bird stones and the bar-amulets.

In the series of more than five thousand chipped implements there are many varied forms ranging from immense knives 10½ inches long and 5 inches broad to tiny arrowheads but little larger than those known as bird points of the Oregon type. There is a wide variety of scrapers, knives, spearheads, drills and other implements of peculiar shape. The range of material shows that the region, especially that of the Seneca river district, acquired much material from foreign sources. The local material is the chert found in the Onondaga limestone but the quantity and variety of extralimital material indicates a traffic with other regions. There is a certain amount of quartz presumably from quartzite boulders, t o g some of the quartz material may have been made from small pebbles. A good share of these implements were made from yellow jasper similar to that found in Berks county, Pa. There is a considerable amount of flinty material similar to that from the Flint ridge, Ohio. It is very evident from an examination of the chipped implements that the common chert or flint was obtained from many sources. The rare materials are moss agate, obsidian, chalcedony and argillite.

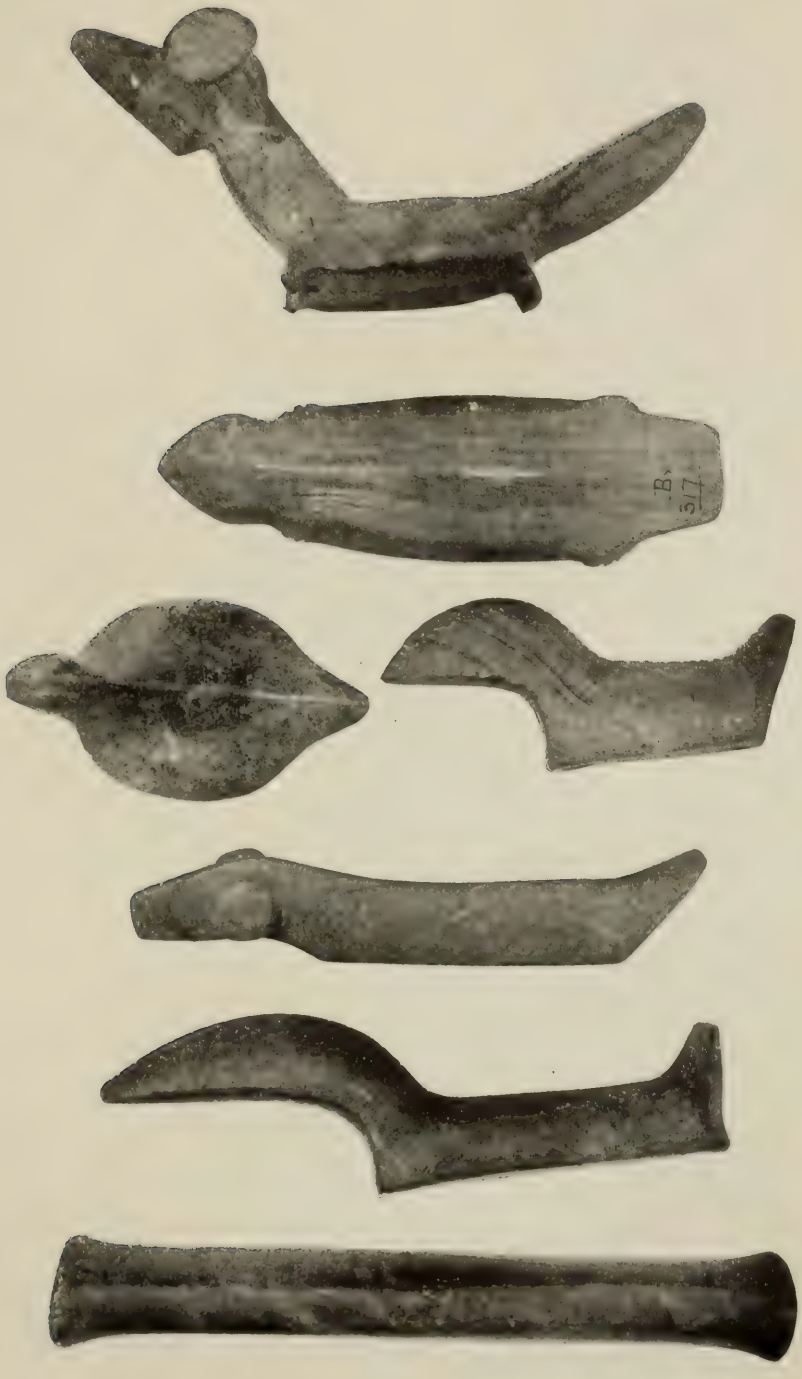
The cutting implements are hatchets, adzes and gouges of several forms. Some of the gouges are flattened on each side

and carry only a short depression terminating not more than one-half the length of the implement, making a short-mouthed gouge. One form of this implement is flattened on the lower surface but rounded on the back. A more finely finished type of gouge has the groove continuing from the cutting edge through to the butt end. With few exceptions, this form of adze is finely finished and polished. The celts consist of three general forms which, however, have subvarieties. The flattened celt seems to have been used mostly as an adze. This form embraces specimens with side equally flattened, specimens with one side flattened and the other slightly rounded, and specimens with one side flattened and the upper portion greatly rounded. A variety of the last named form has the upper side beveled in five planes. A series of small chisels varying from 1½ inches to 3 inches in length coincide with all these described forms. The more general form of the celt consists of specimens averaging about 6 inches in length and having elliptical cross-sections at the center. The cutting edge, as in nearly all forms of these implements, is convex. The material varies from that of diabase, granite, compact sandstone, schist and the more compact forms of metamorphic rock. The third general form is that of the celt having wide cutting edge and tapering down to the butt so that its general form resembles that of the Arawak type. These celts merge, when arranged in series, to the long bar-celt, some specimens of which are 10 or 12 inches long and 1 inch wide and thick. Nearly all the forms of these celts have their counterparts in smaller implements which were presumably used as chisels. The grooved axes from that vicinity are quite rare, not more than a dozen specimens being represented in the collection.

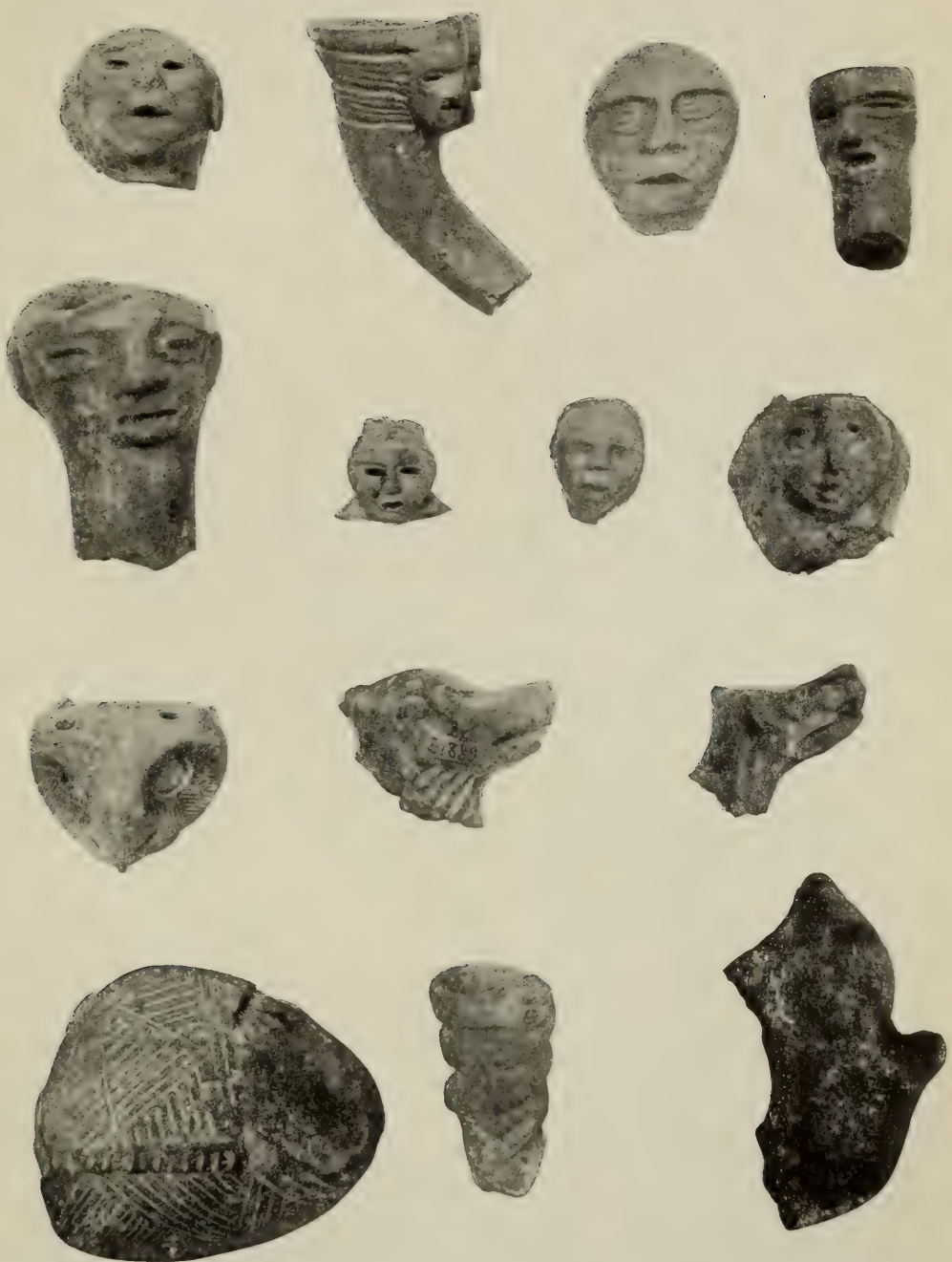
The Bigelow collection of polished slate implements is especially rich in tubes, banner stones, bird stones, and gorgets. There are several varieties of tubes, consisting of specimens partially drilled and others beautifully formed and finely finished, some being cigar-shaped and tapering to a slender stem toward the mouth. Some seem to have been used as pipes while others do not have a form that would indicate this function to have been feasible. The series can be arranged to show the evolution of the stone pipe from the tube form by the gradual uptilting of the bowl end. One specimen, tubular in form, is incompletely drilled and has a pipe stem hole bored in one side. Some of the tubes are short and flattened and are not greatly dissimilar from the narrow winged and thick banner stones.



Banner stones from central New York. Otis M. Bigelow collection



Bird stones and bar amulets from Central New York.
Otis M. Bigelow collection



Effigies from pipe bowls from Onondaga county site. Otis M. Bigelow collection

The collection contains several forms of the banner stone, the more common type being oval in outline with either end truncated. The so-called butterfly shape does not appear and none of the specimens have the indented top and base. Another form is reel-shaped with concave sides. Still another, represented by five specimens resembles up-turned horns. This type is thicker in proportion to the others and the hole somewhat larger. There is a pick-shaped implement with a lateral groove on the flattened under side. This form grades into an oval-shaped pick somewhat resembling a war club head or an elongated sharp-pointed oval. A further evolution shows the type flattened, and then come two specimens of this form which are not drilled. They might have been prepared either for banner stones or for boat stones. The boat stone, however, has two small holes drilled from the under side. It is interesting to note in this connection that all these implements in their various forms may be arranged to show how one shape may merge into another. Thus, it has not been difficult to show how a problematical object shaped in general like a boat may gradually merge into the classification of the gorget or the bird stone. The Bigelow collection is rich in many specimens of both these types and contains many peculiar forms of both the gorget and the bird stone.

There was a time, according to the statements of the older collectors, when the copper implements from the Seneca river and from the western end of Oneida lake were so common that no particular attention was paid to them. If the local collector desired any specimen for his collection it was a finely formed arrowhead, spear, or stone axe. Farmers in that region would save up the copper implements until they had several pounds when they would bring them to the villages and sell them to the tinsmiths. Mr Bigelow, however, was fortunate in preserving about twenty specimens of copper implements. These consist of arrowheads, spears, adzes, chisels and one mattock or pick. Some of the smaller implements have long pronged shafts, similar to that of modern knives, which provide for insertion into a wooden handle. Other types have a flange. The flange in the mattock, which weighs several pounds, is particularly conspicuous. The Museum is fortunate in having this rich collection of New York native copper implements. All the implements resemble in every detail those found in Wisconsin, Michigan and Minnesota and seem to have been made by similar people. Native copper implements are not found inclusively in Iroquois sites in New York.

Another early type of implements are the polished slate knives similar in every way to the Eskimo forms. The ulu or semilunar knife is also of the common Eskimo form. There are several perfect specimens of these objects. Two bayonets made of slate are included in this collection.

There are very few stone pipes in the Bigelow collection, especially those from the pre-Iroquoian occupations. Four or five pipes of the modified monitor type embrace all the specimens obtained by Mr Bigelow. A most interesting form is that of a turtle having the pipe bowl in the center of its back. No stem seems to have been used. Iroquois pipes, however, are fairly numerous and were found on later sites of this occupancy. The clay pipes, especially those from the hills about Pompey, show considerable skill in modeling. The principal decorations are zoomorphic. There are representations of the human face, the human body and hands, and effigies of animals and of birds. On several specimens the effigy of a serpent is used as a decoration.

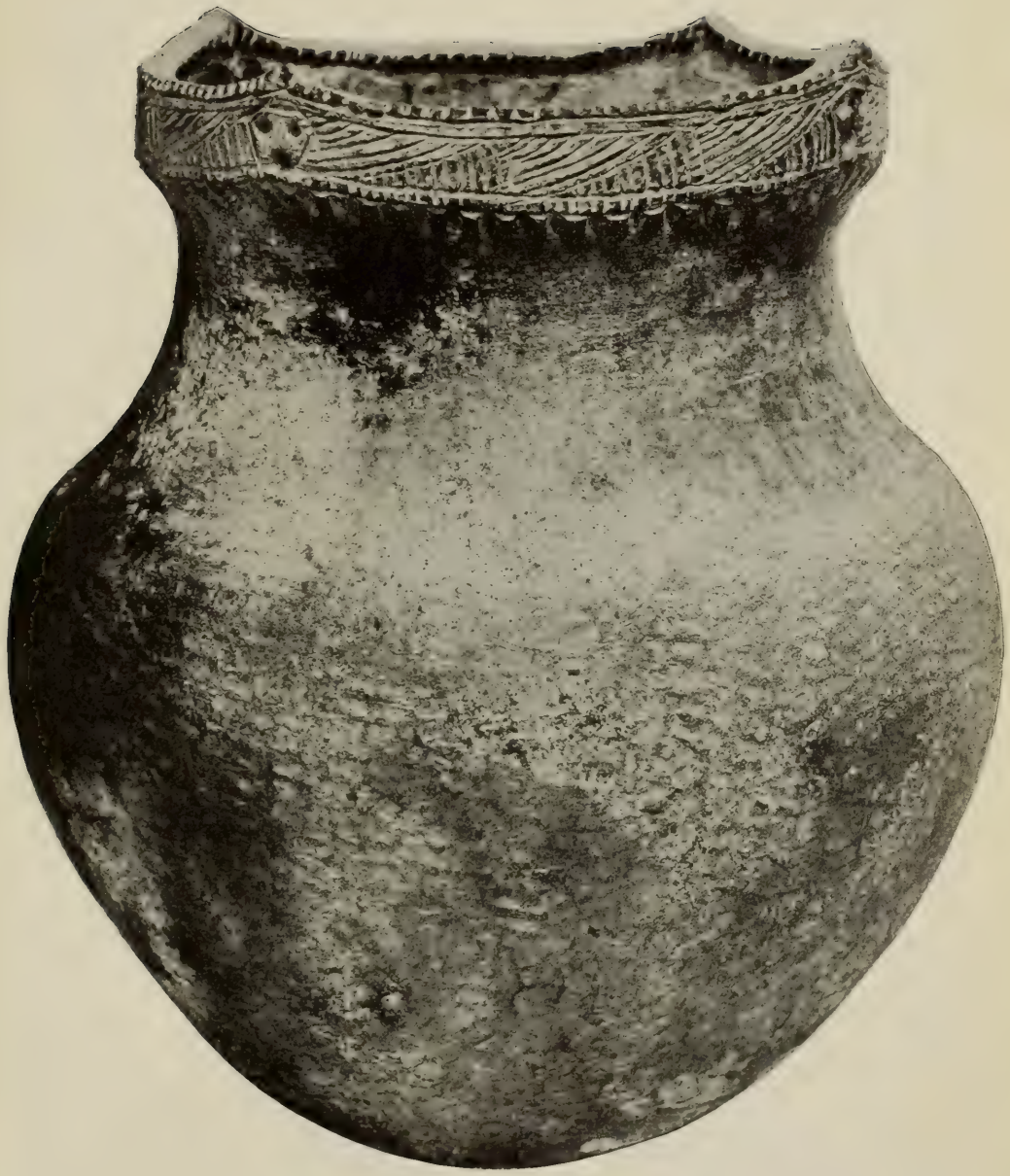
Implements of bone in this collection have come mostly from the Iroquoian sites among the Onondaga hills. They embrace representative series of awls, punches, harpoons, tubes etc. Equally interesting are the objects of antler which embrace arrow points, pitching tools, punches, knife handles, spades and combs. Among the more interesting specimens are the drilled and cut teeth of animals. There are many other forms of implements which we are not able to mention specifically. The Bigelow bone collection has been studied and examined with considerable care and some specimens deserve the closest scrutiny.

Objects of shell are not numerous. Few of the specimens come from the older sites; in fact nearly all specimens have come from sites in which European objects were found.

As may be judged, large quantities of broken pottery were discovered in all the various sites from which Iroquoian implements came. The Iroquoian pottery is similar to that of all other regions where it is discovered; for example, Jefferson county, the Genesee river and western New York.

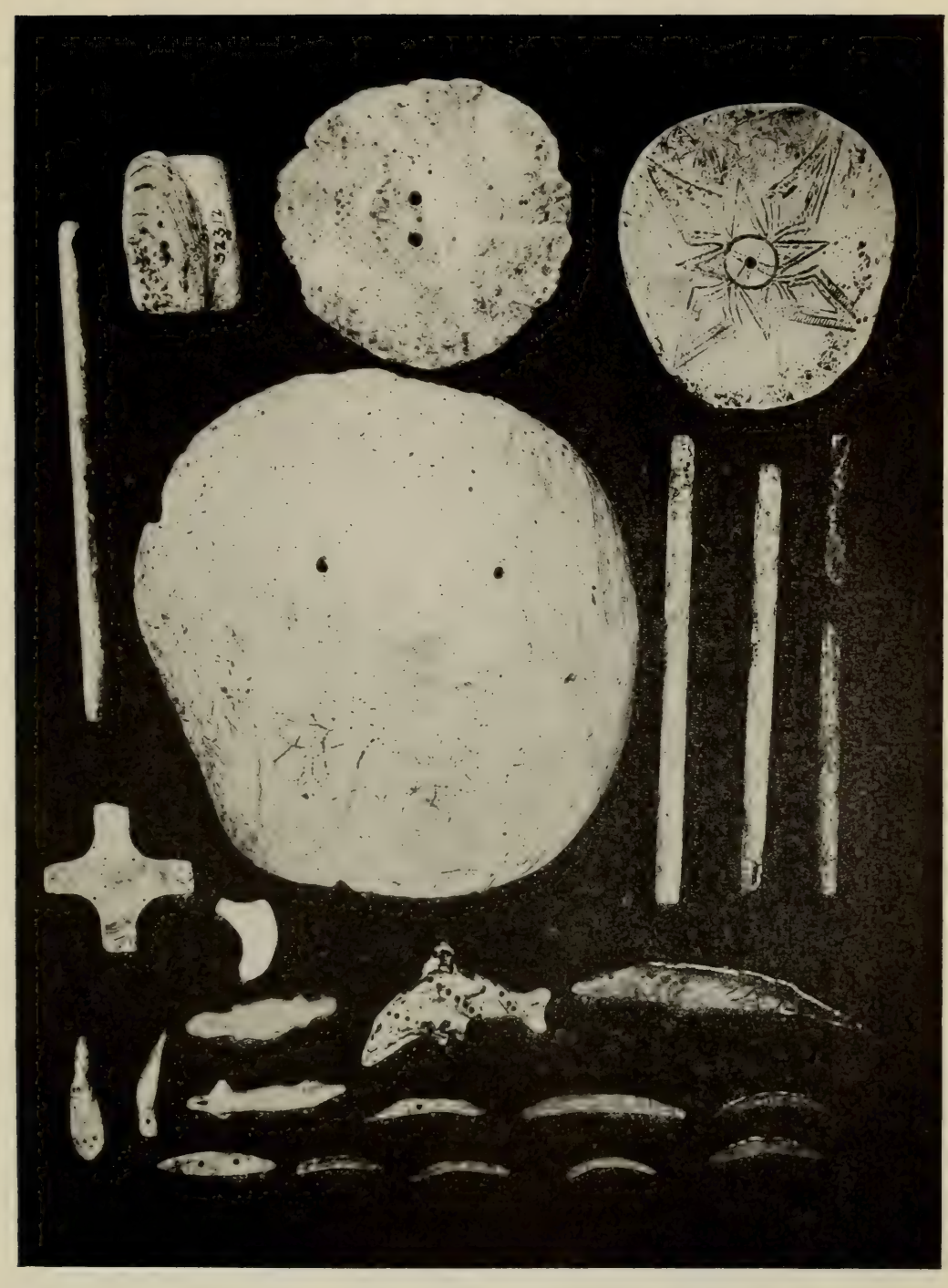
One of the finest complete specimens of the Iroquoian pot ever found is included in the Bigelow collection. It was found by Mr Percy Purdy in a cliff cave on the banks of the Indian river, in the town of Theresa, Jefferson county. It is of typical Iroquoian pattern having a constricted neck and raised collar above which project four points, each 6½ inches apart. At each point is the conventional Iroquoian representation of the human face, made

Semilunar choppers, slate knives and bayonet stones. From Central New York. Otis M. Bigelow collection



Clay vessel from Theresa, Jefferson county. Found in a rock crevice by Percy Purdy

Algonquin clay vessel from Chenango Valley. Otis M. Bigelow collection



Shell ornaments from central New York. Otis M. Bigelow collection

by three dots or small circles. The border decoration is narrow but consists of the usual pattern of parallel oblique lines arranged in triangular plats. The edge of the rim is notched or indented at intervals of about three-eighths of an inch on both inner and outer edges. The pot is 14½ inches high and is 39 inches in circumference at the middle of the globular body.

The inside of the vessel is smooth but the interior of the neck seems to have been given an overwash of clay before baking. It has the appearance of having been smoothed down while the clay was still quite moist. The outer side of the neck is smooth but the body of the vessel has been patted with a potter's paddle having oblong patterns, so that the surface of the clay shows outlines of indented oblongs slightly impressed. The vessel has a fracture, caused no doubt by frost.

The Dwinel F. Thompson collection. The collection brought together by Professor Thompson contains specimens acquired mostly from the upper waters of the Hudson river beginning with certain sites in the vicinity of Troy. The principal sites in the Troy region from which he obtained specimens are Lansingburg, Waterford and Green Island. Northward of this region specimens were acquired in sites from the Hoosick valley, Saratoga county and the Champlain valley, as far north as Plattsburg. The collection embraces a number of important articles from the vicinity of Catskill, N. Y. By exchange, Professor Thompson obtained specimens from Monroe county and by excavation certain material from one or two sites in the Mohawk valley.

Perhaps the most interesting object in the collection is that of a large entire pottery vessel of the Iroquois type. It has a diameter through the body of 9 inches and a height of 10½ inches. An interesting feature of the rim is that it has three projecting points instead of the usual four. These points are regularly placed, being 6⅜ inches apart. The collar is decorated in the usual Iroquoian way with straight lines. The upper portion on the angular edge is notched as is also the inner side of the rim which curves inward sharply. Below the notched edge there are four parallel lines encircling the collar, below which are series of parallel straight lines slanting to the right. The collar terminates into a scalloped bottom overhanging the body of the vessel. The collar is curved inward to the constricted neck which is rather short, being not more than 1½ inches in length. The pot is nearly perfect and there are only slight cracks in it. These run from one side below the center of the body in a V-shaped fracture to the bottom of the pot where

there is a Y-shaped crack. One of the points is also fractured so that it presents a wedge-shaped break. The vessel was found in a rock shelter and still has upon one side to the left and below the broken point an eroded surface yet covered with dry moss. In size, form and decoration it is similar to the many fragments of pottery from the Mohawk valley, in the collection. Nearly all the vessels seem to have been as large or considerably larger than the Thompson specimen.

The specimens in Professor Thompson's collection marked from the Champlain valley indicate there was a continued occupation of the people who made polished stone implements such as bird stones, banner stones, boat stones and gorgets. Ungrooved axes or celts are numerous in this collection and there is a good representation of gouges. Grooved axes are represented by a number of good specimens.

A very interesting locality represented by relics is that in the vicinity of Schaghticoke in the Hoosick valley. The chipped flint implements from this region are numerous and varied in material and form. There are numerous large cache blades, large spearheads, arrow points and an abundance of unworked and rejected flint material. There are also flint hammers and abrading stones. The ordinary celt does not seem to be abundant in this region, there being an almost equal number of grooved axes. There is no clay pottery among the acquisitions of this collection but a considerable number of broken soapstone potsherds. The largest and most finely worked pestle is from this vicinity. It is long and slender and as perfectly formed as can be expected from early artisans. In length it is 21⅝ inches and the diameter of the lower or pounding end is $1\frac{9}{16}$ inches. This tapers to a diameter at the top of three-fourths of an inch. The material seems to be a compact schist of dark color. There are smaller pestles well worked, some being less than 8 inches in length. Stone choppers or crude axes chipped from quartz and limestone were common on the Hoosick valley sites. Among the polished stone implements may be mentioned fragments of finely wrought banner stones including one specimen partially drilled but unfinished.

There are three fragments of the semilunar knife and one entire but unfinished specimen. The largest specimen in the State Museum collection from this vicinity was that presented by Albert C. Hurd and reported two years ago.

Important specimens from the vicinity of Catskill are sinew stones, several finely wrought pestles, several disklike stones and one fine specimen of a semilunar knife.

Mohawk pottery vessel from Mohawk Valley. D. F. Thompson collection

The vicinity of Catskill was an important one to the aborigines who reached it from the Mohawk valley by the way of the Schoharie creek. It was at one time the southern border of the Iroquois possessions but all the specimens from this region represented in the Thompson collection are pre-Iroquoian and presumably Algonkian.

In the Director's Report of 1905 is described a copper necklace taken from a grave in the vicinity of Athens. This necklace may or may not be modern Algonkian. The beads and the workmanship of the shell ornaments with them are similar to those from the so-called mound culture. Some of the Thompson articles are from this region.

Professor Thompson was careful to collect many hundreds of fragments of flint and broken specimens of flint points. From such materials we are able to determine the types of points used for material selected and the various stages of manufacture. The collection contains nearly all the tools of stone used for chipping flint.

The L. D. Shoemaker collection. The collection acquired from Mr L. D. Shoemaker of Elmira contains representative specimens collected on more than thirty sites in the Chemung valley and regions about Elmira. The more important specimens are polished stone implements, large fragments of Algonkian pottery, cylindrical pestles, flat and saucer-shaped mortars and nearly one-half of a large soapstone pot.

Specimens in the Shoemaker collection from the various sites indicate that the occupation of this region was mostly Algonkian. There are numerous crude axes, stone hammers and stone balls with a fine representative series of flint implements and net sinkers and other crude utilitarian objects.

Curatorial work. It has been no easy task to examine the thousands of specimens that have been acquired during the past two years. The work of making complete and thorough examinations of the several collections has, however, been an imperative requirement due to the necessity of selecting not only the proper material for exhibition but to set aside valuable material for study. It is gratifying to report that, though many other demands were made upon this section of the Museum, more than thirty thousand such examinations were made, and by the close of the year the Archeologist had selected and set aside such objects as are to be shown in the exhibition compartments. The archeologic cases of the C and D types, as soon as installed in the present hall of archeology, were filled with specimens. The B cases containing wooden steps, which had originally been ordered for the botanical exhibits,

were found inadequate for our purposes and had to be changed. The material eventually to be installed in them, however, was entirely selected before the close of the year and will be ready for installation shortly after January 1, 1915.

In the examination of collections containing so great a quantity of material there is afforded a splendid opportunity for obtaining important information regarding the occurrence of the various types and their distribution.

The work of cataloging the many objects has been intrusted to Mr Howard A. Lansing. This tedious and painstaking work he has carried on with great patience. All the new acquisitions are now numbered and recorded on cards and each specimen bears a number referring to its index card. This card gives the name of the object, the locality in which it was found, the finder, the collection in which it was found and a brief description. Further reference is made to the original catalogue or notebook of the collector. To complete our catalogue satisfactorily will require much additional time, as these cards will contain accurate descriptions of all the objects, and drawings or photographs of the more valuable ones.

None of the specimens have the index or reference number applied by means of a paper label, which has proved unsatisfactory for archeologic cataloging. All numbers are applied by pen or brush directly upon the specimen with waterproof ink. The number is placed in as inconspicuous a place as possible so as not to detract from the exhibition value of the object or unduly mar its appearance.

Archeological exhibit cases. During the middle of the year it was found that the archeology division was gaining such importance that a hall separate from the ethnological exhibits was required. The hall assigned to botany seemed not likely to be used for some time to come. Room 415, the eastern mezzanine, was therefore set aside as the archeology hall. The cases designed for archeology and previously installed in the hall of ethnology, room 420 (the west mezzanine hall), were removed and installed in room 415. The cases designed for the botanist were rearranged and the hall fitted for the archeological exhibits.

Public interest. During the year just past there has been a healthy increase in the interest in the archeological division of the Museum. This is not only attested by the many inquiries and requests, but also by the personal visits of archeologists and ethnologists from this country, Canada, South America and Europe. There

is a constantly growing demand for the publication of our manuscripts and for information concerning the facts of New York archeology and ethnology.

Facts are constantly required by artists, students, historians, producers of plays, pageants and historical exercises. There is also an increasing demand for suitable Indian names for geographical localities, for estates, camps, boats, clubs, and commercial concerns. The Archeologist suggested most of the names, for example, for the various mineral springs at Saratoga. Suggestions and plans for out-of-door pageants were given to several organizations, including the Lake Placid Club, the Agricultural College at Cornell, and the American Scenic and Historic Preservation Society; the Boy Scouts, Camp Fire Girls and similar clubs have been furnished with names, symbols and practical suggestions bearing on Indian life. Our activity during the year has covered a wide range of subjects of the present-day interest.

We are assured that our Iroquois Indians themselves look to the Museum and its Indian division as the chief means for the preservation of their history and records. In connection with the Indian of today we have therefore sought to represent them and their interests in various organizations and conferences, a duty that the Universal Law would seem amply to justify.

IX

PUBLICATIONS

A list of the scientific publications issued during the year 1913–14, with those now in press and treatises ready for printing, is attached hereto. The publications issued cover the whole range of our scientific activities. They embrace 1498 pages of text and 190 plates.

ANNUAL REPORT

1 Tenth Report of the Director, State Geologist and Paleontologist for the fiscal year ending September 30, 1913. 158p. 29pl.

Contents

Introduction
I Condition of the new Museum
New Museum cases
Progress of installation
II Report of the Geological Survey
Civic geology
Board of Geographic Names
Areal geology
Surficial geology
Industrial geology
Mineralogy
Paleontology
III Report of the State Botanist
IV Report of the State Entomologist
V Zoology
VI Report of the Archeologist
VII Publications
VIII Report on the collection of coins, medals and paper money
IX Staff of the Department of Science
X Accessions
Appendix
The Origin of Man (adapted from paper by Dr E. Rivet)
Index

MEMOIRS

Zoology

2 No. 12 Birds of New York, volume 2. General Chapters; Land Birds. 719p. 64pl.

Contents

Introductory note
Bird ecology
The economic value of birds
The status of our bird laws
Special measures for increasing bird life
Bird refuges
Private preserves
Description of genera and species
Addendum: New York bird history since 1910
Explanations of plates
Index

BULLETINS

Geology and Paleontology

3 No. 168 The Geological History of New York State. By William J. Miller. 1913. 130p. 43pl. 10 maps.

Contents

Preface
Chapter 1: Introduction
Chapter 2: Physiographic provinces, structure and drainage

Chapter 3: Precambric History
Chapter 4: Paleozoic history
Chapter 5: Mesozoic history
Chapter 6: Cenozoic history
Appendix
Bibliography
Index

4 No. 169 Geology of Saratoga Springs and Vicinity. By H. P. Cushing and R. Ruedemann. 1914. 178p. 20pl. Map.

Contents

Introduction
Location and character
General topography
General geology
Descriptive geology
Historical geology
Economic geology
Control of development and history of Saratoga region by the geology
Index

5 No. 170 Geology of the North Creek Quadrangle, Warren County, New York. By William J. Miller. 1914. 90p. 14pl.

Contents

Introduction
General topography and geology
Rocks of the region
Structural features
Topography
Glacial and postglacial geology
Summary of geological history
Economic geology
Index

6 No. 171 The Geology of the Syracuse Quadrangle. By Thomas Cramer Hopkins. 1914. 80p. 20pl.

Contents

Introduction
Geologic column of the Syracuse area
Stratigraphy
Economic geology
Structural geology
Physiographic features
Periodotite dikes
Notes on the Fossils of the Paleozoic Formations within the Syracuse Quadrangle. Burnett Smith
A Review of the Mammalian Remains from the Superficial Deposits in the Vicinity of Onondaga Lake, New York. Burnett Smith
Explanations of plates
Index

7 No. 172 Geology of the Attica-Depew Quadrangles. By D. D. Luther. 1914. 32p. Map.

Contents

Introduction
Description of formations
Siluric
Devonic
Bibliography
Index

8 No. 174 The Mining and Quarry Industry of New York State. By D. H. Newland. 1914. 111p.

Contents

Introduction
Mineral production of New York
Cement
Clay
Production of clay materials
Common building brick
Front brick

Common hollow brick
Fireproofing
Terra cotta
Drain tile
Pottery
Paving brick
Emery
Feldspar
Garnet
Gypsum
Iron Ore
Mica
Mineral waters
Natural gas
Petroleum
Salt
Sand and gravel
Sand-lime brick
Stone
Production of stone
Granite
Limestone
Marble
Sandstone
Trap
Talc
Zinc
Index

X

STAFF OF THE DEPARTMENT OF SCIENCE

The members of the staff, permanent and temporary, of the Department of Science as at present constituted are:

ADMINISTRATION

John M. Clarke, Director
Jacob Van Deloo, Director's Clerk
Paul E. Reynolds, Stenographer

GEOLOGY AND PALEONTOLOGY

John M. Clarke, State Geologist and Paleontologist
David H. Newland, Assistant State Geologist, *Curator of Geology*
Rudolf Ruedemann, Assistant State Paleontologist, *Curator of Paleontology*
C. A. Hartnagel, Assistant in Geology, *Curator of Stratigraphy*
Robert W. Jones, Assistant in Economic Geology, *Assistant Curator of Industrial Geology*
D. Dana Luther, Field Geologist
Herbert P. Whitlock, Mineralogist, *Curator of Mineralogy*
George S. Barkentin, Draftsman
H. C. Wardell, Preparator, *Assistant Curator of Paleontology*
Theodore J. Lipsky, Stenographer
Charles P. Heidenrich, Mechanical Assistant
Joseph Bylancik, Junior Clerk

Temporary experts

Areal geology

Prof. H. P. Cushing, Adelbert College
Prof. C. H. Smyth, jr, Princeton University
Prof. James F. Kemp, Columbia University
Prof. W. J. Miller, Hamilton College
Dr C. P. Berkey, Columbia University
G. H. Hudson, Plattsburg State Normal School
Dr W. O. Crosby, Massachusetts Institute of Technology
Prof. George H. Chadwick, St Lawrence University
James C. Martin, Princeton University

Geographic geology

Prof. Herman L. Fairchild, University of Rochester
Prof. James H. Stoller, Union College

Paleontology

Edwin Kirk, Washington, D. C.
Winifred Goldring, Slingerland
Edwin J. Stein, Albany

BOTANY

Charles H. Peck, State Botanist
Homer D. House, Assistant, *Curator of Botany*

ENTOMOLOGY

Ephraim P. Felt, State Entomologist
D. B. Young, Assistant State Entomologist, *Curator of Entomology*
Fanny T. Hartman, Assistant, *Assistant Curator of Entomology*
Anna M. Tolhurst, Stenographer
A. S. McGaughan, Page

ZOOLOGY

Willard G. Van Name, Zoologist, *Curator of Zoology*
Arthur Paladin, Taxidermist

Temporary experts

Prof. E. Howard Eaton, Canandaigua
Dr H. A. Pilsbry, Philadelphia
Charles E. Mirguet, Rochester

ARCHEOLOGY

Arthur C. Parker, Archeologist, *Curator of Archeology and Ethnology*
Noah T. Clarke, Technical Assistant, *Assistant Curator of Archeology and Ethnology*

Temporary assistant

Howard A. Lansing, Albany

XI

ACCESSIONS TO THE COLLECTIONS

MINERALOGY

Donation

L. G. Sheldon, Richville
Serpentine (asbestos) Gouverneur..... 3
C. A. Hartnagel, Albany
Calcite. Black Cape, Canada..... 60
Barite and calcite. Black Cape, Canada..... 33
Mrs Charles S. Phelps, Canton
Amphibole (mountain leather) Canton..... 8
H. S. Peck, Albany
Calcite (large), New Baltimore..... 1
Galena, Ellenville 1
Harvard Museum, Cambridge, Mass.
Millerite and garnet, Orford, Quebec, Canada..... 2
Vesuvianite, Orford, Quebec, Canada..... 2
Hodgkinsonite, Franklin Furnace, N. J..... 2
R. W. Jones, Albany
Malachite, Elko county, Nevada..... 2
Azurite, Elko county, Nevada 1
Copper, Elko county, Nevada..... 1

Exchange

William Carpenter, Butte, Mont.
Covellite, Leonard mine, Butte, Mont..... 3
Enargite, Leonard mine, Butte, Mont..... 2
Chalcocite, Leonard mine, Butte, Mont..... 1
Bornite, Leonard mine, Butte, Mont..... 2
Case School of Mines, Cleveland, Ohio
Celestite, Put-in-Bay, Ohio..... 1

Collected

D. H. Newland, Albany
Quartz (scepter crystal), Bedford..... 1

Purchased

W. A. Bentley, Jerico, Vt.
Photo prints of forms of water..... 111
E. S. Law, Schenectady
Epidote on gneiss, Mayfield..... 3
Quartz (crystals), Amsterdam 10
Garnet in schist, Charlemont, Mass..... 2
Gahnite in schist, Charlemont, Mass..... 1
Amphibole in schist, Charlemont, Mass..... 1
Amphibole (pseudomorph), Charlemont, Mass..... 1

Charles Ellery, Albany

Gold in quartz, Weller mine, Telluride, Col	1

Gebhard collection

Pyrite, Schoharie county	56
Strontianite, Schoharie county	9
Calcite, Schoharie county	1
Barite, Schoharie county	14

Silas Young collection, Warwick

Graphite, Edenville	2
Graphite, Amity	1
Molybdenite, Mount Eve, Orange county	1
Galena, Ellenville	3
Galena, Guymard	2
Sphalerite, Otisville	1
Sphalerite, Ellenville	3
Covellite, Ellenville	1
Chalcopyrite, Ellenville	2
Chalcopyrite, Otisville	1
Pyrite, Edenville	1
Pyrite, Schoharie	1
Löllingite, Edenville	1
Fluorite, Amity	2
Fluorite, Muscolonge Lake	1
Yttrocerite, Edenville	6
Quartz, Edenville	4
Quartz, Ellenville	3
Quartz, Otisville	2
Quartz, Little Falls	180
Quartz (basonite), Edenville	2
Hematite, Antwerp	1
Ilmenite, Amity	9
Spinel, Amity	27
Spinel, Edenville	15
Magnetite (jenkinsite), Monroe	3
Magnetite, Brewsters	1
Rutile, Edenville	1
Limonite, Staten Island	2
Limonite, Amity	2
Calcite, Lockport	3
Calcite, Rossie	1
Calcite, Pitcairn	1
Calcite, Amity	3
Calcite (tufa), Schoharie county	1
Calcite (satin spar), St Lawrence county	1
Siderite, Antwerp	1
Azurite, Amity	1
Orthoclase, Edenville	1
Oligoclase, Edenville	3
Labradorite, Edenville	1
Labradorite, Washingtonville	1

Pyroxene, Edenville 10
Wollastonite, Amity 1
Amphibole, Edenville 22
Amphibole (edenite), Edenville 18
Amphibole, Amity 11
Amphibole, Gouverneur 1
Amphibole, Edwards 2
Amphibole, Hastings 1
Garnet, Amity 1
Garnet, Brooklyn 1
Chrysolite, Edenville 1
Anthophyllite, New York City 2
Anthophyllite, Staten Island 1
Wernerite, Edenville 2
Wernerite, Amity 3
Vesuvianite, Amity 1
Zircon, Edenville 1
Epidote, Highland 2
Allanite, Edenville 7
Chondrodite, Brewsters 1
Chrondrodite, Edenville 15
Tourmaline, Edenville 13
Tourmaline, Amity 3
Muscovite, Edenville 3
Biotite, Rossie 2
Biotite, Edenville 2
Phlogopite, Amity 5
Seybertite, Amity 11
Serpentine, Amity 7
Serpentine, Edenville 4
Serpentine, Staten Island 3
Serpentine, Brewsters 1
Serpentine, Newburgh 1
Titanite, Edenville 7
Titanite, Amity 1
Apatite, Edenville 1
Warwickite, Edenville 10
Gypsum, Lockport 1
Sulphur, Sicily 1
Selensulphur, Girgenti, Sicily 2
Tellurium, Keystone Lode, Colo 2
Bismuth, Monroe, Conn 1
Gold, Nevada 1
Silver, Michigan 1
Copper, Cornwall, Pa. 2
Copper, New Haven, Conn 1
Copper, Michigan 2
Realgar, Banat, Hungary 1
Stibnite, California 1
Molybdenite, Ross, Ontario, Canada 1

Molybdenite, Frankfort, Pa.	1
Whitneyite, Houghton, Mich.	1
Domeykite, Houghton, Mich.	1
Argentite, Virginia City, Nev.	1
Petzite, Springdale, Colo.	1
Galena, Cumberland, England	1
Galena, Marsdons Diggins, Wis.	2
Galena, Galena, Ill.	1
Galena, Poor Man's Lode, Idaho	1
Chalcocite, Cheshire, Conn.	1
Chalcocite, California	1
Stromeyerite, Beaver Creek, Colo.	1
Sphalerite, Derbyshire, England	1
Sphalerite, Friedensville, Pa.	1
Sphalerite, Roxbury, Conn.	1
Sphalerite, Franklin, N. J.	3
Sphalerite, Hungary	1
Coloradoite, Ballarat, Colo.	1
Cinnabar, Napa county, Cal.	3
Chalcopyrite, Bristol, Conn.	1
Chalcopyrite, North Carolina	1
Linnaeite, Siegen, Westphalia, Germany	1
Pyrite, Franklin, N. J.	1
Pyrite, Roxbury, Conn.	2
Pyrite, Utah	2
Pyrite, Richmond, Mass.	1
Pyrite (nodules), Illinois	1
Arsenopyrite, Roxbury, Conn	1
Greenockite, Franklin, N. J.	1
Jamesonite, Cornwall, England	1
Bournonite, Cornwall, England	1
Sylvanite, Dunaven Lode, Colo.	1
Proustite, Austin, Nev.	1
Enargite, Colorado	1
Fluorite, Cumberland, England	4
Fluorite, Alston Moor, England	2
Fluorite, Durham, England	1
Fluorite, Saxony	2
Fluorite, Rosiclaire, Ill.	1
Fluorite, Franklin, N. J.	1
Cryolite, Ivigtuk, Greenland	2
Atacamite, Atacama, Chili	1
Pachnolite, Ivigtuk, Greenland	2
Quartz, Paterson, N. J.	5
Quartz, Roxbury, Conn.	1
Quartz, Cornwall, England	1
Quartz, Cheshire, Conn.	2
Quartz, Cumberland, England	2
Quartz (geodes), Brunces Creek, Ill.	4
Quartz, Pikes Peak, Colo.	3

Quartz, Moosuk, Conn. 1
Quartz, New Augusta, Ill..... 2
Quartz, Vernon, N. J..... 1
Quartz (amethyst), Brazil 1
Quartz (amethyst), Thunder Bay, Ont..... 3
Quartz (amethyst), Ontario, Canada..... 1
Quartz (chrysoprase), Kosemitz, Silesia..... 1
Quartz (phrase), Oppenau, Baden..... 1
Quartz (chalcedony), Mount Lebanon, Syria..... 1
Quartz (agatized wood), California..... 1
Quartz (jasper), India 1
Quartz (agate), Wood Basin, Neb..... 1
Quartz (agate polished), Brazil..... 10
Quartz (moss agate), Nevada..... 2
Quartz (itacolumite), North Carolina..... 1
Quartz (chalcedony), Florida 2
Quartz (rose), Bavaria 1
Quartz (agate), Brazil 5
Quartz (amethyst), Hungary 1
Quartz, Paterson, N. J..... 2
Quartz (geode), Missouri 1
Quartz, St Gothard, Switzerland..... 1
Quartz, Phoenixville, Pa. 1
Quartz, Cumberland, England 1
Quartz, Roxbury, Conn..... 2
Quartz, Nova Scotia, Canada..... 1
Quartz (aventurine), Giersdorf, Saxony..... 1
Quartz, Brazil 2
Opal, Mexico 2
Opal, Hungary 2
Opal (wood opal), Libethen, Hungary..... 2
Opal (hyalite), British Columbia..... 1
Opal (semi), Bohemia 1
Opal (semi), Colorado 1
Opal (pitch stone), Meissen, Saxony..... 2
Opal (hyalite), Auvergne, France..... 1
Stibiconite, Gold Hill, Nev..... 2
Cuprite, California 1
Cuprite, Cornwall, Pa..... 4
Cuprite, Cornwall, England..... 1
Zincite, Franklin, N. J..... 10
Corundum, Vernon, N. J..... 6
Corundum, Franklin, N. J..... 2
Corundum, Clay Co., N. C..... 2
Hematite, Elba, Italy..... 1
Hematite, Spain 2
Hematite, Germany 1
Hematite, Cumberland, England 1
Spinel, Ogdensburg, N. J..... 2
Gahnite, Bodenmais, Bavaria..... 1

Magnetite, Chester, Pa.	1
Franklinite, Franklin, N. J.	19
Hausmannite, Ilmenau, Thuringia	1
Cassiterite, Schlackenwald, Bohemia	2
Cassiterite, Durango, Mexico	1
Rutile, Graves Mountain, Ga.	1
Rutile, Magnet Cove, Ark.	4
Rutile, Lancaster Co., Pa.	1
Octahedrite, Tavatsch, Tyrol	1
Brookite, Magnet Cove, Ark.	2
Pyrolusite (dendrite), Pensburg, Pa.	1
Diaspore, Chester, Mass.	3
Diaspore, Hungary	1
Göthite, Cheshire, Conn.	1
Manganite, Ihlfield, Germany	1
Limonite, Ogdensburg, N. J.	3
Limonite, Vernon, N. J.	3
Brucite, Texas, Pa.	3
Chalcophanite, Ogdensburg, N. J.	13
Hydrotalcite, Vernon, N. J.	5
Calcite, Joplin, Mo.	1
Calcite, Kewenaw Co., Mich.	1
Calcite, Warsaw, Ill.	1
Calcite, India	1
Calcite, Ontario, Canada	1
Calcite, Smithfield, R. I.	1
Calcite, Bergen Hill, N. J.	3
Calcite, Globe, Ariz.	1
Calcite, Franklin, N. J.	2
Calcite, Cumberland, England	1
Calcite, Iceland	2
Calcite (stalactite), Mammoth Cave, Ky.	2
Calcite (pistolitic), Carlsbad, Germany	2
Calcite, Zacatecas, Mexico	1
Calcite (polished stalactite), California	1
Calcite (stalactite), Iowa	1
Calcite (stalactite), Bermuda	2
Calcite (oolitic), England	1
Dolomite, Cumberland, England	1
Dolomite, Connecticut	1
Dolomite (gurhofite), Montville, N. J.	1
Magnesite, Tyrol	1
Magnesite, Texas, Pa.	1
Siderite, Alston Moor, Eng.	1
Siderite, Ivigtuk, Greenland	1
Siderite, Germany	1
Rhodochrosite, Franklin, N. J.	4
Rhodochrosite, Cornwall, England	1
Smithsonite, Mineral Point, Wis.	1
Smithsonite, Ogdensburg, N. J.	4

Aragonite, Cumberland, England 3
Aragonite, Columbia, Pa. 1
Aragonite, Girgenti, Sicily 1
Aragonite (flos ferri), Austria..... 2
Bromlite, Cumberland, England 1
Witherite, Cumberland, England 1
Strontianite, Argyleshire, Scotland..... 1
Cerussite, Ems, Germany..... 1
Barytocalcite, Hartz, Germany..... 1
Malachite, Cheshire, Conn..... 3
Malachite, Bembe, West Africa..... 1
Azurite, Chessy, France..... 1
Azurite, Cornwall, Pa. 1
Azurite, Australia 1
Hydrozincite, Ogdensburg, N. J..... 2
Zaratite, Texas, Pa. 1
Petalite, Bolton, Mass..... 1
Orthoclase, Drachenfels, Bonn, Germany..... 1
Orthoclase, Ontario, Canada..... 1
Microcline, Pikes Peak, Colo..... 5
Microcline, Franklin, N. J..... 4
Microcline (graphic granite), Hadden, Conn..... 1
Microcline, Rockport, Mass. 1
Albite, St Gothard, Switzerland..... 1
Albite, Zillerthal, Tyrol 1
Albite, Perth, Canada 1
Albite, Middletown, Conn. 2
Oligoclase, Middletown, Conn. 1
Oligoclase, Medea, Pa. 1
Oligoclase (moonstone), Mineral Hill, Pa..... 1
Labradorite, Labrador 1
Hypersthene, Buckston, Me..... 2
Pyroxene, Ogdensburg, N. J..... 8
Pyroxene, Tyrol 1
Spodumene, Rumford, Me. 1
Spodumene, Chesterfield, Mass. 1
Pectolite, Bergen Hill, N. J..... 3
Rhodonite, Franklin, N. J..... 10
Rhodonite, Cranston, R. I 1
Anthrophyllite, Burlington, Conn..... 1
Amphibole, Russell, Mass. 1
Amphibole, Zillerthal, Tyrol 1
Amphibole, Ogdensburg, N. J..... 3
Amphibole, Young county, N. C..... 1
Amphibole, New Hampshire..... 1
Amphibole (cummingtonite), Polk co., Tenn..... 1
Beryl, Germany 1
Beryl, Tyrol 1
Beryl, Haddam, Conn. 1
Beryl, Norway, Me. 1

Beryl, Leperville, Pa.	1
Iolite, Haddam, Conn.	1
Iolite (fahlunite), Fahlum, Sweden	1
Nephelite, Litchfield, Me.	1
Nephelite, Mount Somma, Sicily	1
Cancrinite, Litchfield, Me.	2
Cancrinite, Gardner, Me.	1
Sodalite, Kicking Horse Pass, B. C.	1
Haüynite, Laachen See, Eifel, Germany	1
Danalite, Rockport, Mass.	1
Garnet, Franklin, N. J.	10
Garnet, Hamburg, N. J.	1
Garnet, Ogdensburg, N. J.	3
Garnet, Warren, N. H.	2
Garnet, Monroe, Conn.	1
Garnet, Gatineau, Canada	2
Garnet, Leperville, Pa.	1
Garnet, Orford, Quebec	1
Garnet, Silverberg, Baden, Germany	1
Garnet, Reading, Conn.	1
Chrysolite, Eifel, Germany	1
Willemite, Franklin, N. J.	12
Wernerite, Bathhurst, Canada	1
Vesuvianite, Eker, Norway	1
Vesuvianite, Sanford, Me.	1
Topaz, Monroe, Conn.	1
Topaz, Thomas Range, Utah	1
Topaz, San Luis Potosi, Mexico	33
Topaz, Brazil	4
Andalusite, Lancaster, Mass.	6
Sillimanite, Norwich, Conn	1
Cyanite, New Britain, Conn	1
Cyanite, Barkhamsted, Conn.	1
Cyanite, Bethesda, Pa.	1
Datolite, Roaring Brook, Conn	1
Datolite, Bergen Hill, N. J.	2
Datolite, Ontonagon county, Mich	1
Zoisite, Tyrol	1
Epidote, Willimantic, Conn.	3
Epidote, Lake Superior, Mich	1
Epidote, Untersulzbachthal, Tyrol	1
Hancockite, Franklin, N. J.	2
Axinite, Dauphiny, France	1
Prehnite, Paterson, N. J.	20
Chondrodite, Sparta, N. J.	1
Cerite, Bastnas, Sweden	1
Calamine, Ogdensburg, N. J.	34
Tourmaline, Rumford, Me.	4
Tourmaline, Hamburg, N. J.	1
Tourmaline, Franklin, N. J.	2

Tourmaline, Middletown, Conn. 1
Tourmaline, Paris, Me. 1
Tourmaline, Chesterfield, Mass. 1
Staurolite, North Carolina 5
Staurolite, Fanning county, Ga..... 4
Staurolite, Lisbon, N. H..... 1
Apophyllite, Bergen Hill, N. J..... 1
Apophyllite, Paterson, N. J..... 1
Heulandite, Paterson, N. J..... 5
Heulandite, Nova Scotia 2
Stilbite, Nova Scotia 1
Stilbite, Frankford, Pa. 1
Stilbite, Ontonagon county, Mich..... 1
Stilbite, Paterson, N. J..... 2
Gismondite, Mount Vesuvius, Italy..... 1
Laumontite, Paterson, N. J..... 2
Chabazite, Wasson's Bluff, N. S..... 1
Chabazite, Jones Falls, Md..... 1
Chabazite, Nova Scotia..... 1
Analcite, Seisson Alp, Tyrol..... 1
Analcite, Bergen Hill, N. J..... 2
Analcite, Keweenaw county, Mich..... 1
Analcite, Jalisco, Mexico 1
Natrolite, Paterson, N. J..... 2
Mesolite, Giant's Causeway, Ireland..... 1
Thomsonite, Paterson, N. J..... 1
Thomsonite (faroelite), Faroe islands..... 1
Muscovite, Fairville, Pa. 1
Muscovite, Mount Airy, N. C..... 1
Muscovite, Trumbull, Conn. 1
Muscovite, Pennsborough, Pa. 1
Muscovite, Stoneham, Me. 2
Lepidolite, Middletown, Conn. 1
Lepidolite, Bogna, Moravia 1
Lepidolite, Saxony, Germany..... 1
Lepidolite, Paris, Me. 1
Lepidolite, Hebron, Me. 1
Phlogopite, South Burgess, Canada..... 1
Lepidomelane, Litchfield, Me. 1
Roscoelite, Kekomo, Colo..... 1
Margarite, Chester, Mass..... 1
Chlorotoid, Warwick, R. I..... 1
Clinochlore, Lerni, Pa. 1
Clinochlore, Bermingham, Pa. 1
Penninite (pseudophite), Markirch, Alsace..... 1
Jefferisite, High Bridge, N. J..... 1
Protovermiculite, Magnet Cove, Ark..... 1
Caswellite, Franklin, N. J..... 2
Serpentine, New Haven, Conn..... 1
Serpentine, Vernon, N. J..... 5
Serpentine, Montville, N. J..... 8

Serpentine, Franklin, N. J. 2
Serpentine, Easton, Pa. 1
Serpentine (williamsite), Cornwall, Pa. 1
Serpentine (bowenite), Smithfield, R. I. 1
Serpentine (williamsite), Texas, Pa. 1
Serpentine (baltimorite), Texas, Pa. 1
Serpentine, Cornwall, England 1
Deweylite, Maryland 1
Talc, Chester, Mass. 2
Talc, Upper Egypt 2
Thaumasite, Paterson, N. J. 1
Catlinite, South Dakota 1
Chrysocolla, Cornwall, Pa. 7
Chrysocolla, Heckle Mine, Idaho 1
Titanite, Vernon, N. J. 1
Titanite, Renfrew county, Canada 3
Astrophyllite, Larnoe, Norway 1
Pyrophyllite, Orange county, N. C. 1
Fergusonite, Ytterby, Sweden 1
Columbite, Middletown, Conn. 1
Columbite, Rumford, Me. 1
Yttrotantalite, Ytterby, Sweden 1
Triphyllite, Bavaria 1
Beryllonite, Stoneham, Me. 1
Apatite, Renfrew county, Canada 4
Apatite, Spain 1
Pyromorphite, Ems, Nassau, Germany 3
Pyromorphite, Phoenixville, Pa. 1
Amblygonite, Hebron, Me. 1
Olivinite, Cornwall, England 2
Vivianite, Mullica Hill, N. J. 3
Varisite, Montgomery county, Ark. 1
Varisite, Garland county, Ark. 1
Wavellite, Garland county, Ark. 3
Wavellite, Bohemia 1
Wavellite, White House, Pa. 1
Pharmacosiderite, Cornwall, England 1
Childrenite, Cornwall, England 1
Beudantite, Dembach, Nassau, Germany 1
Boracite, Holstein, Germany 1
Borax, California 1
Uraninite, Flat Rock, N. C. 1
Barite, Nova Scotia 1
Barite, Alston Moor, England 1
Barite, Cheshire, Conn. 2
Celestite, Girgenti, Sicily 5
Anglesite, Phoenixville, Pa. 1
Anhydrite, Stassfurt, Germany 1
Anhydrite, Wurtemburg, Germany 1
Gypsum, Bologna, Italy 1
Gypsum (fibrous), Wales, England 2

Gypsum (alabaster), New Brunswick, Canada 1
Cyanotrichite, La Garonne, France 1
Wolframite, Zinnwald, Saxony 1
Scheelite, Zinnwald, Saxony 1
Wulfenite, Tacoma mine, Nev 2
Wulfenite, Southampton, Mass 1
Succinite, Baltic sea, Germany 1
Albertite, Nova Scotia 1
Jet, Whitby, England 1

Ward's Natural Science Establishment, Rochester
Tourmaline, Misa Grande, Cal 4

1544

PALEONTOLOGY

Donation

Brown, Thomas C. Bryn Mawr, Pa.
Callograptus grabaui Hahn, from Spring Creek formation, Spring Creek near Bellefonte, Pa 1

Buehler, Dr H. A. Rolla, Mo.
Oriskany fossils from St Genevieve county, Mo 8

Foerste, Dr Aug. F. Dayton, Ohio
Large spine of eurypterid from the Utica shales near Rome, N. Y... 1

Gilbert, Frank. Albany
Grammysia hamiltonenis, from Indian Fields, Albany county 1

Hudson, Prof. George H. Plattsburg
Types of Blastoidocrinus carchariaedens Billings (sp.) used in Museum Bulletin 107 12

McMaster, J. Glens Falls
Trilobite from Amsterdam limestone, Glens Falls 1

Schuchert, Dr Charles. New Haven, Conn.
Dictyonema from basal Ordovicic, Navy Island, St John, N. B., Canada 9

Purchase

Gebhard, W. D. Schoharie, N. Y.
Fossils from the following formations in Schoharie county:

Hamilton	260
Agoniatites limestone	58
Onondaga limestone	530
Schoharie grit	1430
Oriskany sandstone	1260
Becraft limestone	18
New Scotland limestone	1195
Coeymans limestone	670
Manlius limestone	298
Cobleskill limestone	294
Total	6013

Kinnear, W. T. Kirkbuddo, Forfar, Scotland

Birkenia elegans Traq. Upper Siluric, Seggholm, Muirkirk, Ayr, Scotland 1

Thelodus scoticus Traq. Seggholm, Muirkirk, Ayr, Scotland 2

Tealliocaris londonensis Peach. Scottish Calciferous sandstone, Lower Carboniferous England..... 1

Krantz, Dr F. Bonn, Germany

Foreign Cambric fossils..... 24

Collection

Burmaster, E. R. Irving

Upper jaw of bison from Indian grave near Irving, N. Y..... 1

Luther, D. D. Naples

Devonic fossils (mostly from Cashaqua beds) from western New York 101

Hartnagel, C. A. Albany

Fossils from the Siluric section on north side of the Bay of Chaleur, in the vicinity of Black Cape, P. Q., Canada..... 300

Fossils from the Siluric section on south side of the Bay of Chaleur at Petite Roche, New Brunswick, Canada..... 20

Fossils from Siluric section at Limestone Point, 2 miles north from Petite Roche, New Brunswick, Canada..... 10

ENTOMOLOGY

Donation

Hymenoptera

Goodyear, Charles. Tarrytown. Vespa crabro Linn., European hornet, adult and work on birch twig, December 16, January 14

Jeffries, F. M. New York City. Through State Department of Agriculture. Same as preceding, work on white birch, August 26

Moore, Albert. Mount Kisco. Isosoma orchidearum Westw., Cattleya or orchid Isosoma, infested buds, larvae, pupae and adults on Cattleya, July 2

Phelps, Vincent. Newburgh. Aphelinus fuscipennis How., San José scale parasite, December 5

Albright, M. C. Salisbury, Md. Same as preceding, infesting San José scale on Symphoricarpos, December 8

Kingman, Frank. Schodack. Same as preceding, on San José scale, December. Also Prospaltella perniciosi Tower, on San José scale, December

Budd, Mrs John. Schodack. Same as preceding

Masten, Dr Edward. Schodack. Same as preceding

Niles, F. T. Mamaroneck. Same as preceding

Guernsey, W. A. Saratoga Springs. Megarhyssa atrata Fabr., black long sting, adult on maple, June 13

Bailey, Mrs E. J. Coeymans. M. lunator Fabr., lunate long sting, adult, August 6

Gardner, Mrs E. P. Canandaigua. Rhodites rosaelfolii Ckll., lenticular rose gall, on Rosa blanda, September 8. Also R. globuloides Beutm., globose rose gall; R. dichlocerus Harr., long rose gall

Bethel, E. Denver Col. Aylax pisum Walsh, galls on Lygodesmia juncea, October 15

Burnham, S. H. Hudson Falls. Diastrophus fusiformans Ashm., gall on blackberry, September

de Vyver, J. James. Mount Vernon. D. nebulosus O. S., adults and galls on blackberry, May 5

Walker, R. S. Chattanooga, Tenn. Callirhytis cornigera O. S., gall on Quercus palustris, May 20

de Vyver, J. James. Mount Vernon. C. punctata Bass., knotty oak gall, adults and galls on Quercus, May 5

Berby, J. A. and **Parker, H. L.** Clemson College, S. C. C. palustris O. S., galls, April 30. Also C. seminator Harr., wool sower gall, galls on Quercus; Amphibolips confluens Harr., oak apple gall, galls on Quercus; A. inanis O. S., empty oak apple, galls on Quercus; Holcaspis globulus Fitch, bullet gall, galls on Quercus

Bethel, E. San José, Cal. Dryophanta echinus O. S., galls on Quercus agrifolia, August 23

de Vyver, J. James. Mount Vernon. Neuroterus noxiosus Bass., noxious oak gall, adults and young, on Quercus, May 5

Sherwood, J. W. Spring Valley. Same as preceding, galls and adult on Quercus, July 10

Rice, W. C. Birch Island, Upper Saranac. Through State Conservation Commission. Hylotoma pectoralis Leach, larvae on white birch

Carbary, H. J. Childwold. Pteronus integer Say, currant stem borer, larvae on currant, August 6

Sands, H. C. Lynbrook. P. ventralis Say, yellow-spotted willow slug, larvae on willow, August

Butler, A. W. Mount Kisco. Lophyrus abbotii Leach, Abbott's pine sawfly, larvae on pine, September 30

Coleoptera

Newman, G. W. Waverly. Dendroctonus terebrans Oliv., turpentine bark beetle, workings in pine, June 4

Levison, J. J. Brooklyn. Phloeosinus dentatus Say, red cedar bark beetle, larvae and work on red cedar, June 15, also adults and work, September 8

de Vyver, J. James. Mount Vernon. Xyleborus celsus Eich., Ambrosia beetle, adult on hickory, May 5

Pomeroy, F. Cooperstown. Cryptorhynchus lapathi Linn., mottled willow and poplar curculio, on poplar, July 11

Van Fredenberg, H. A. Port Jervis. Pomphopoea sayi Lec., Say's blister beetle, adult, June 8

Wiltsie, A. J. Feura Bush. Same as preceding, June 13

Seeber, C. Canajoharie. Same as preceding

Ritter, Miss Hazel C. Little Falls. Same as preceding, adults on locust, June 13

Feily, J. H. Rensselaer. Same as preceding, adults destroying bean blossoms, June 17

de Vyver, J. James. Mount Vernon. Nyctobates pennsylvanica De G., adult on hickory, May 5

Stout, A. B. New York City. Bruchus hibisci Oliv., in seeds of Hibiscus militaris, January 13

Hubbard, G. C. Red Hook. Galerucella luteola Müll., elm leaf beetle, adult, May 11

Marshall, C. C. Millbrook. Same as preceding, May 18

Merritt, Mrs Douglas. Rhinebeck. Same as preceding, May 25

Tate, L. A. Gloversville. Same as preceding, adults and eggs on elm, June 5

Blackman, H. W. Syracuse. Same as preceding, eggs and larvae on elm, June 12

Hammond, Benjamin. Illinois. Diabrotica duodecimpunctata Oliv., 12-spotted Diabrotica, September 11

de Vyver, J. James. Mount Vernon. Gastroidea cyanea Melsh., adults, May 5

Crittenden, Mrs W. H. Cornwall. Nodonota puncticollis Say, adults on rose, June 16

Griffith, L. C. Lynbrook. Through State Department of Agriculture. Typophorus canellus Fabr., strawberry root worm, work on strawberry, August

Hunter, David. San Antonio, Texas. Fidia cana Horn, adult on grape, May 16

Slade, M. P. Mount Kisco. Saperda calcarata Say, poplar borer, larva and work on Lombardy poplar April 24

de Vyver, J. James. Mount Vernon. Graphisurus fasciatus DeG., on hickory, June 22. Also Hetoemis cinerea Oliv., on mulberry, June 22

Kelly, William. Blue Mountain Lake. Monohammus confusor Kirby, sawyer, on balsam, July 20

Armstrong, A. C. Warner. Elaphidion villosum Fabr., maple and oak twig pruner, larvae and work on hickory, June 2

Rosenbaum, F. G. New York City. Same as preceding, grubs and work on oak, July 3

Davies, W. D. New York City. Same as preceding, July 7

Goodwin, A. S. New York City. Same as preceding, July 8

Moore, H. P. White Plains. Same as preceding, July 13

Gordinier, H. W. & Sons. Troy. Same as preceding, larvae on oak, July 21

Carpenter, C. K. New York City. Same as preceding, July 24

Blackburn, Mrs John T. D. Crater Club, Essex County. Same as preceding, July 24

Chipp, R. D. Nyack. Same as preceding, July 30

Lansing, Miss Gertrude. Ogunquit, Me. Callidium antennatum Newm., blue pine borer, on spruce, June 26

Taylor, J. M. Albany. Osmoderma ? scabra Beauv., rough flower bettle, larvae at base of decaying oak posts, October 14

de Vyver, J. James. Bronxville. Ligyrus relictus Say, June. Also Lachnosterna arcuata Sm.; L. barda Horn; L. fusca Froh.; L. micans Knoch.; L. hirticula Knoch.; L. fraterna Harr.; L. crenulata Froh.

Lacey, F. H. Boston Corners. L. dubia Sm., June 10

Latham, Roy. Orient. Same as preceding, adult, June 25. Also L. fusca Froh.; L. hirticula Knoch.; L. tristis Fabr.

Tucker, Gilbert. Altamont. L. fusca Froh., June beetle, May 19

Marshall, D. T. Hollis. L. micans Knoch., May 22. Also L. fraterna Harr.

Lacey, F. H. Boston Corners. Same as preceding, adult, June 19

Davis, J. J. Lafayette, Ind. L. crassissima Blanch., L. implicita Horn, L. vehemens Horn, L. arcuata Sm., L. hirticula Knoch., L. gibbosa Burm., L. inversa Horn, L. bipartita Horn, L. congrua Lec., L. torta Lec., L. affinis Lec., L. crenulata Froh., January 28

Marshall, D. T. Hollis, L. I. Diplotaxis tristis Kirby, May 22

de Vyver, J. James. Bronxville. Same as preceding, June

Le Brun, G. P. Far Rockaway. Macrodactylus subspinosus Fabr., rose chafer, adults on peaches, June 16

Tucker, G. M. jr. Glenmont. Same as preceding, adults destroying strawberries, June 17

Sihairer, George. Scotia. Same as preceding, adults, June 21

Riddell, Samuel. Huntington. Serica iricolor Say, adult on oak, June 3

Latham, Roy. Orient. S. sericea Ill., adult, June 25

Von Schrenk, Hermann. St Louis, Mo. Lyctus planicollis Lec., powder post beetle, adults on ash, March 12

Cogswell, G. E. Jamaica. L. opaculus Lec., powder post beetle, adults, May 23

Branion, H. A. Chatham. Sitodrepa panicea Linn., drug store beetle, adult, June 19

Cole, T. L. Catskill. Chauliognathus pennsylvanicus De G., adult, September 3

Levison, J. J. Brooklyn. Agrilus bilineatus Web., two-lined chestnut borer, work in oak, November 24. Also A. anxius Gory, bronze birch borer, work on black birch, September 9

Peck, N. C. Hartsdale. A. otiosus Say, work on dogwood, March 9

Baldwin, E. A. Schenectady. Glischrochilus quadriguttatus Fabr., adults on melon plant, July 20

Armer, H. N. Kingston. Attagenus piceus Oliv., black carpet beetle, adults, May 7

Harrison, David. Staatsburg. Staphylinus maculosus Grav., rove beetle, adult, March 6

Diptera

Cox, Townsend jr. Setauket. Culex subcantans Felt, adult, July 7

State Department of Agriculture. Fisher's Island. Cecidomyia serotinae O. S., gall on wild cherry, January 19

Burnham, S. H. Hudson Falls. Cecidomyia sp., gall on Laportea canadensis, July 6. Also Itonida foliora Rssl. & Hkr., gall on Quercus, September

Latham, Roy. Orient. Obolodiplosis robiniae Hald., gall on Robinia, August 25

Mac Gregor, E. A. Mound, La. Arthrocnodax carolina Felt, May 25

Bethel, E. Denver, Col. Hormomyia crataegifolia Felt, gall on Crataegus coloradensis, July 7

Burnham, S. H. Hudson Falls. Caryomyia caryae O. S., gall on Carya, September

Cosens, A. Toronto, Can. ? Contarinia negundifolia Felt, galls on Acer negunda, July 12. Also Phytophaga rigidae O. S., galls on willow, April 29; Oligotrophus salicifolius Felt, galls on Salix humilis, July 12

Bethel, E. Burlingame, Cal. Thecodiplosis pini-radiatae Snow & Mills, galls on Pinus radiata, August 23. Also from Denver, Col., Rhopalomyia betheliana Ckll., galls on Artemisia filifolia, October 15

Kellogg, V. L. Stanford University, Cal. Thecodiplosis pini-radiatae Snow & Mills, September 18

Latham, Roy. Orient. Cincticornia pilulae Walsh, gall on Quercus, September 22. Also Rhopalomyia anthophila O. S., gall on Solidago, September 22; R. racemicola O. S.; Sackenomyia viburnifolia Felt, gall on Viburnum; Oligotrophus salicifolius Felt; Lasioptera farinosa Beutm., gall on Rubus; L. lycopi Felt, gall on Lycopus; Neolasioptera erigerontis Felt, gall on Erigeron, June 25; Cystiphora canadensis Felt, gall on Prenanthes, August 25

Burnham, S. H. Hudson Falls. Rhopalomyia solidaginis Lw., gall on Solidago, September. Also Lasioptera corni Felt, gall on Cornus; Neolasioptera clematidis Felt, gall on Clematis; Dasyneura communis Felt; Rhabdophaga salicifolia Felt; Winnertzia hudsonica Felt

Gardner, Mrs E. P. Canandaigua. Lasioptera desmodii Felt, gall on Canadian tick trefoil, September 8

Seeger, Mrs Charles L. Patterson. Dasyneura communis Felt, galls on maple, June 18

Stene, A. E. Kingston, R. I. D. parthenocissi Steb., gall on woodbine, June 26

Theobald, F. V. Wye, Kent, England. D. pyri Bouché., pear leaf-curling midge, adults on pear, November

Hewitt, C. G. Ottawa, Can. D. rodophaga Coq., larvae on rose, August 10

Britton, W. E. Essex, Conn. Rhabdophaga salicifolia Felt, gall on hardhack, August 18

Malloch, J. R. Havana, Ill. Agromyza aristata Malloch & Hart, paratype, May 11

Bradley, Miss Helen E. Cato. Eristalis tenax Linn., drone fly, rat-tail larva from stock well, September 18

Greene, Mrs Horace L. Fort Plain. Scenopinus fenestralis Linn., carpet fly, larva under carpet, February 7

Lepidoptera

Hodges, C. C. Utica. Papilio troilus Linn., green-clouded swallow-tail, larva on Benzoin odoriferum, September 28

Bradley, Miss Helen E. Cato. Eurymus philodice Godart, adults, September 18

Brackett, E. T. Saratoga Springs. Euvanessa antiopa Linn., spiny elm caterpillar, larvae, June 10

Wadsworth, Austin. Geneseo. Through State Department of Agriculture. Same as preceding, larvae on elm, June 12

Thomas, J. M. Yonkers. Same as preceding, adult, August 11

Marshall, D. T. Hollis, L. I. Sphecodina abbotii Swain, Abbott's sphinx, larvae on grape, July 24

Woodward, A. J. Hadley. Same as preceding, adult, July 31

Briggs, C. M. Chicago, Ill. Through J. Eyer. Pholus achemon Dru., larva, July 21

Peck, C. H. Menands. Paonias myops Sm. & Abb., adult, June 24

Whaley, F. J. Rensselaerville. Halisidota caryae Harr., adult on maple, August 8

Van Orden, Mrs C. H. Catskill. Macronoctua onusta Grt., larvae on Iris, August 12

Audubon, M. R. Salem. Agrotis scandens Riley, climbing cutworm, larvae on corn, June 25

Howard, G. C. Garden City. Through Doubleday, Page & Co. Mamestra picta Harr., zebra caterpillar, larva on Japanese Iris, July 14

Marshall, D. T. Hollis, L. I. Heliophila unipuncta Haw., army worm, larvae on grasses, July 18

Travell, Howard. New York City. Same as preceding, adult, September 2

Jausen, E. B. Kingston. Xylina antennata Walk., green fruit worm, adults, March 31, April 1 and 18

Tate, L. A. Gloversville. Same as preceding, June 5

Wadsworth, Austin. Geneseo. Through State Department of Agriculture. Same as preceding, larvae on elm, June 12

Ogden, A. T. Kinderhook. Heliothis armiger Hübn., cutworm, larvae on corn, July 30

Ganong, F. J. Crafts. Same as preceding, larva and work on corn, October 29

Chipp, R. D. Nyack. Same as preceding, larvae on corn, August 12

Huested, P. L. Blauvelt. Through M. M. Kennedy. Abrostola triplasia Linn., dark spectacle, pupa on Magnolia, March 20

Baxter, M. S. Rochester. Alabama argillacea Hübn., cotton moth, adults, September 25 and October 20

Laney, C. C. Rochester. Same as preceding, adults, September 25

Wade, T. J. New Rochelle. Datana integerrima Grt. & Rob., black walnut caterpillar, exuviae on black walnut, August 24

State Department of Agriculture. Fisher's Island. Euproctis chrysorrhoea Linn., brown-tail moth, winter nests, January 2

Van Patten, S. B. Union. Malacosoma americana Fabr., apple tent caterpillar, eggs on apple, January 31

Lyon, E. Katonah. Same as preceding, March 4

Barron, Leonard. Garden City. Same as preceding, larvae, May 5

Van Clefe, J. O. Oakdale, L. I. Same as preceding, larvae and tent, May 18

Tate, L. A. Gloversville. Same as preceding, adult, June 5

Lodge, W. S. Chilson Lake. Same as preceding, cocoon, July 15

Hicks, J. J. Jericho, L. I. Same as preceding, egg masses, August 31

Blunt, Miss Eliza S. New Russia. M. disstria Hübn., forest tent caterpillar, larvae, May 28

Wadsworth, Austin. Geneseo. Through State Department of Agriculture. Same as preceding, larvae on elm, June 12

Nichols, J. W. Saratoga Springs. Same as preceding, adults, June 16

Riley, J. E. Through State Conservation Commission. Same as preceding, cocoon on pine, June 17

Winthrop, Beekman. New York City. Same as preceding, cocoons and cast skins, June 18

Blunt, Miss Eliza S. New Russia. Same as preceding, cocoons and old egg belts, June 20

Leavitt, J. L. Russell. Same as preceding, larvae and cocoons, July 1

Owens, Frank. Horicon. Same as preceding, larvae and cocoons, July 3

Janack, John jr. Wanakena. Same as preceding, larvae, July 4

Witherbee, F. S. Port Henry. Same as preceding, cocoons, July 7

Ahearn, Michael. Clayburgh. Same as preceding

Phelps, C. A. Canton. Same as preceding, cocoons, July 15

Smith, Mrs C. McClellan. Cambridge. Same as preceding, exuviae on sugar maple, September 8

Morey, C. L. Greenwich. Paleacrita vernata Peck, spring canker worm, June 7. Also Erannis tiliaria Harr., 10-lined inch worm

de Vyver, J. James. Mount Vernon. Same as preceding, work, June 22

Horner, H. H. Albany. Eustroma diversilineata Hübn., larvae on woodbine, June

Latham, Roy. Orient. Cingilia catenaria Dru., September 22

Dodge, J. H. Nebraska. Thyridopteryx ephemeraeformis Haw., bagworm, bag on apple, March 26

Millers Nursery. South Jamaica. Through State Department of Agriculture. Same as preceding, on Styrax, August 4, 12

George, Miss Margaret. Yonkers. Sibine stimulea Clem., saddleback caterpillar, larva on oak, October 16

Griffith, L. C. Lynbrook. Through State Department of Agriculture Prolimacodes scapha Harr., Skiff Limacodes, larvae on flowering crabapple, October 6

Goodyear, Charles. Tarrytown. Zeuzera pyrina Linn., leopard moth on apple, December 16

Mager, C. E. New York City. Same as preceding, work on linden, September 11

Braucher, R. W. Western Maryland. Prionoxystus robiniae Peck, larva, July 20

Seaver, F. J. New York City. Podosesia syringae Harr., ash borer, adult, larvae and exuviae on ash, October 5

Zimmer, C. H. Lynbrook. Through State Department of Agriculture. Phlyctaenia ferrugalis Hübn., greenhouse leaf-tyer, adults on chrysanthemum, December 2

Burnham, S. H. Hudson Falls. Same as preceding, larva on marsh field fern, June 19

Lacy, F. H. Millerton. Crambus caliginosellus Clem., sooty Crambus, larvae on corn, June 12

Pulver, H. W. Pine Plains. Same as preceding, larva, June 24

Conklin, E. W. Salt Point. Same as preceding, larvae on corn, July 6

Clark, S. J. Mount Vernon. Dioryctria reniculella Grote, spruce cone worm, larvae in spruce cones, July 8

Livingston, J. H. Tivoli. Tmetocera ocellana Schiff., bud moth on cherry buds, April 8

Bradford, W. H. Ellenville. Archips cerasivorana Fitch, ugly nest cherry worm, larvae, July 7

Callan, A. S. Chatham. Same as preceding, adults, July 7

Waterman, Alfred. Twaddell Point Station, East Branch. A. fervidana Clem., larvae on oak, July 14

Harris, S. G. Tarrytown. Tortrix fumiferana Clem., spruce bud worm, pupae on spruce, June 1

Whitinger, Mrs E. C. Schenectady. Same as preceding, larvae on spruce, June 3

Stoneman, W. G. Albany. Same as preceding, larvae on blue spruce, June 4

Patch, Miss Edith M. Orono, Me. Same as preceding, pupae in hemlock and balsam, June 25

Parmelee, Robert. Oswegatchie. Same as preceding, larvae on spruce, July 7

Hicks, Isaac & Son. Westbury. Dichomeris marginellus Fabr., Juniper webworm, cocoon and work on Swedish Juniper, December 15

Merkel, H. W. New York City. Same as preceding, larva on Juniper, April 11

de Vyver, J. James. Mount Vernon. Coleophora limosipennella Dup., elm case-bearer, larvae on elm, June 22

Kurz, G. M. Oyster Bay, L. I. Same as preceding, July 22

de Vyver, J. James. Mount Vernon. C. fletcherella Fern., cigar case-bearer, larvae on elm, June 22

Platyptera

Van Bergen, Irving. Schoharie. Corydalis cornuta Linn., Dobson fly, larvae, June 3

Morehouse, Mrs H. C. Howes Cave. Same as preceding, adult, June 26

Ephemeridae

Alexander, C. P. Northampton. Baetisca obesa Say, larvae, May 24. Also Siphlonisca aerodromia Ndh., Mayfly, larvae, May 24

Horton, Theodore. Albany. Cleon sp., larvae from water supply, December 8

Hemiptera

Rose, J. F. South Byron. Cicada linnei Grossb., August 16

Bahnsen, C. Lake Placid. ? Ormenis pruinosa Say, lightning leaf hopper, young on wild cherry, July 14

Smith, J. H. Chestertown. Aphrophora parallela Say, parallel spittle insect, nymphs on pine, July 3

Van Duzee, E. P. La Jolla, Cal. Bythoscopus franciscanus Baker, June 21. Also Thamnotettix heidemanni Ball, June 21

Lawrence, C. C. Newburgh. Through Frost & Bartlett Co. Alebra albostriella Fall., on Norway maple, July 16

Bethel, E. Denver, Col. Pachypsylla venusta O. S., gall on Celtis reticulata, December 1

Hays, Miss A. K. South Nyack. Phylloxera caryaecaulis Fitch, hickory gall aphid, gall, June 23

Frost & Bartlett Co. Stamford, Conn. Same as preceding, July 2

Openhyme, Mrs. St Huberts. Through State Department of Agriculture. Chermes floccus Patch on spruce, December 16

Goodyear, Charles. Tarrytown. C. abietis Linn., spruce gall aphid on spruce, January 14

Dummett, Arthur. Mount Vernon. Same as preceding, August 6

Barrus, G. L. Lake Placid Club, Essex County. Same as preceding, September 2

Luke, Walter. New York City. C. strobilobius Kalt., woolly larch aphis, eggs on pine, May 4

Seaver, A. J. New York City. Same as preceding, eggs and young on larch, May 5

Nill, John. Watertown. C. cooleyi Gill., aphid spruce gall, gall on spruce, July 7

Foord, A. G. Kerhonkson. C. pinicorticis Fitch, pine bark aphid, adults and young on white pine, May 3

Wade, T. J. New Rochelle. Pemphigus populi-globuli Fitch, galls on Lombardy poplar, June 18

Lyon, Edwin. Katonah. Colopha ulmicola Fitch, cockscomb elm gall, galls on elm, July 1

Tate, L. A. Gloversville. Schizoneura lanigera Hausm., woolly aphis on elm leaves, June 5

Livingston, J. H. Tivoli. Same as preceding, June 9

Judson, J. D. Vernon. Same as preceding, June 10

Blunt, Miss Eliza S. New Russia. Same as preceding, adults and young on elm leaves, June 20

Hereford, Miss Alice C. Watertown. Same as preceding, June 22

Howell, W. W. Poughkeepsie. Same as preceding, adult on slippery elm, June 23

Greene, Mrs Horace L. Fort Plain. Same as preceding, July 5

Naramore & Young. Rochester. Phyllaphis fagi Linn., woolly beech leaf aphis, adults and young on beech, September 19

Becker, Miss Emily F. Catskill. Chaitophorus aceris Linn., Norway maple plant louse, adults on Norway maple, July 9

Naramore, M. J. Ossining. Drepanosiphum acerifolii Thos., on maple, May 25

Nill, John. Watertown. Mindarus abietinus Koch., balsam aphid, work on balsam, July 7

Heilman, J. R. Poughkeepsie. Aphis sorbi Kalt., rosy aphis, adult and young, July 2

Howell, W. W. Poughkeepsie. Myzus cerasi Linn., black cherry aphis, adult on cherry, June 23

Niles, H. W. Mount Kisco. Paraleyrodes mori Quaint., adults on Kalmia, July 3

King, G. B. Lawrence, Mass. Kermes pubescens Bogue, on white oak, May 14. Also K. cockerelli Ehrh., on Quercus kelloggi, May 14; K. nivalis King & Ckll., on Quercus rubra; K. essigii King, on Quercus agrifolia

Witherbee, F. S. Port Henry. Physokermes piceae Schr., spruce bud scale, adults and young on Norway spruce, July 7

Dummett, Arthur. Mount Vernon. Same as preceding, galls on spruce, August 6

House, H. D. Near Oneida, Madison county. Pseudococcus ledi Ckll., scale on Ledum groenlandicum, August

Bunn, E. Yonkers. Pulvinaria vitis Linn., cottony maple scale, adult on grape, May 9

Waterman, Alfred. Twaddell Point Station, East Branch. Same as preceding, egg sacks on maple, July 14

Goodyear, Charles. Tarrytown. Gossyparia spuria Mod., elm bark louse on elm, December 16

Mead, F. L. Mechanicville. Same as preceding, female on elm, June 18

Kurz, G. M. Oyster Bay, L. I. Same as preceding, July 22

Turner, J. D. Kingston. Phenacoccus acericola King, false maple scale, young on sugar maple, April 24

Hammond, Benjamin. Fishkill. Same as preceding, adults on sugar maple, September 2

Cockerell, T. D. A. Los Banos, P. I. Phenacaspis mischocarpi Ckll. & Rob., on Mischocarpus, June 24. Also Protopulvinaria longivalvata bakeri Ckll.

Levison, J. J. Brooklyn. Eulecanium nigrofasciatum Perg., black-banded scale, young scales on Sycamore, December 30

New York Farmer. Port Jervis. Same as preceding, young on sugar maple, November 19

Goodyear, Charles. Tarrytown. E. tarsale Sign., soft scale on dogwood, December 16

Livingston, J. H. Tivoli. E. tulipiferae Cook, tulip tree scale, adults on tulip tree, July 30

Wheeler, Dr W. M. San Lucas Toliman, Guatemala. Neolecanium sallei Sign., Lecanium scale, adult on Erythrina sp., February

Griffith, L. C. Lynbrook. Icerya purchasi Mask., cottony cushion scale, adults and young on Acacia, October 23

Levison, J. J. Brooklyn. Chionaspis americana Johns., scurfy elm scale, eggs on elm, October 17

Hicks Nurseries. Westbury. Same as preceding, eggs on Ulmus americana, November 7. Also C. corni Cooley, on Cornus, December 5

Goodyear, Charles. Tarrytown. Same as preceding, on elm, December 16

Kraisman, D. Brooklyn. Same as preceding, June 2

Whaley, F. J. Albany. Same as preceding, young on elm, July 8

Goodyear, Charles. Tarrytown. C. furfura Fitch, scurfy scale on pear, December 16

Lacy, F. H. Poughkeepsie. Same as preceding, eggs on apple, March 26

Fulton, James. Hayworth, Ill. Through Benjamin Hammond, Fishkill. Same as preceding, eggs on pear, April 20

Goodyear, Charles. Tarrytown. C. euonymi Comst., Euonymus scale, on shrubs and vines, December 16; on Euonymus and Celastrus, January 14

Mac Gregor, J. C. Mount Kisco. Through State Department of Agriculture. Same, adults and young on Euonymus radicans, February 24

Merkel, H. W. New York City. C. pinifoliae Fitch, pine leaf scale, eggs on pine, April 16

Harris, S. G. Tarrytown. Same as preceding, eggs on Pinus cembra, May 2

Cockerell, T. D. A. Los Banos, P. I. Hemichionaspis uvariae Ckll. & Rob., on Uvaria, June 24

Hicks Nurseries. Westbury. Diaspis carueli Targ., Juniper scale, adults on Juniperus virginiana, November 7

Levison, J. J. Brooklyn. Same as preceding, on red cedar, March 16

Merkel, H. W. New York City. Same as preceding, eggs on cedar, April 16

Gordinier, H. W. & Son. Troy. Aulacaspis rosae Sandberg, rose scale on rose, December 19

Cockerell, T. D. A. Los Banos, P. I. Odonaspis schizostachyi Ckll. & Rob., on Schizostachyum, June 24

Goodyear, Charles. Tarrytown. Aspidiotus abietis Schr., hemlock scale on hemlock, January 14

Merkel, H. W. New York City. Same as preceding, eggs on hemlock, April 16

Whaley, F. J. Albany. A. ancylus Putn., Putnam scale, adults on linden, July 8

Moore, Albert. Mount Kisco. A. hederae Vall., white scale, adults on Cattleya, July 2

Goodyear, Charles. Tarrytown. A. perniciosus Comst., San José scale on weeping cherry, December 16

State Department of Agriculture. A. rapax Comst., greedy scale, adult on Baytree, November 11

Kerin, Mrs W. E. Troy. Through H. W. Gordinier. Lepidosaphes ulmi Linn., oyster shell scale, eggs on apple, April 8

Mc Master, Miss M. L. Greenwich. Same as preceding, eggs on lilac, May 11

Cassidy, C. P. Poultney, Vt. Same as preceding, eggs and young, June 26

Soule, Miss M. S. Quaker Street. Chlorochroa uhleri Stal., Juniper plant bug, adults on corn, September 11. Also nymphs and adults, August 23; Euschistus variolarius Pal. Beauv., adults

State Department of Agriculture. Maryland. Arilus cristatus Linn., wheel bug, eggs, December 22

Strickland, L. F. Lockport. Paracalocoris scrupeus Say, nymphs, June 3. Also Neurocolpus nubilis Say, adult on sumac, July 7

Shons, C. R. Washingtonville. Lygidea mendax Reut., false red bug, work on apple, June 12

Gregory, E. S. Niverville. Same as preceding, June 19

de Vyver, J. James. Mount Vernon. Same as preceding, work on apple leaves, June 22

Heilman, J. R. Poughkeepsie. Same as preceding, work, July 2

Duell & Son, C. H. Bangall. Same as preceding, July 6

Lacy, F. H. Poughkeepsie. Same as preceding, July 8. Also from Hyde Park, adults, July 10

Orthoptera

Bradley, Miss May C. Cato. Melanoplus femoratus Burm., two-striped grasshopper, adult, September 29. Also M. femur-rubrum De G., red-legged grasshopper, adult; Encoptolophus sordidus Burm., sordid grasshopper, adult

Thysanura

Cox, D. H. New York City. Lepisma domestica Pack., silver-fish or slide, adult, March 25

Harris, William. Saratoga Springs. Lipura ambulans Linn., in greenhouse soil, February 5

Purchase

Kny-Scheerer Co. New York City

Lepidoptera (butterflies and moths)

Ornithoptera zalmoxis
O. hekuba
Papilio blumei
Teniopalpus imperialis
Papilio rhodifer
P. agenor
Morpho anaxibia
Attacus atlas
Brahmea whitei
Thysania agrippina
Geometrid
Erebus odora
Ophideres aurantia
Ornithoptera rhadamanthus
Morpho sulkowskyi
Stichophthalma camadera
Thaumantis diores
Papilio majo
Eploe vestigiata
Bunnaea caffraria
Hyperchiria janus
Epiphora banhiniae
Nudaurelia ringleri
Gynanisa maja
Phyllodes sp.
Graellsia isabellae
Ornithoptera lydius
Morpho polyphemus
Ornithoptera urvilleana

Coleoptera (beetles)

Catoxantha opulenta
Mormolyce phyllodes
Odontolabis lowei
Calosoma sycophanta
Chrysina macropus
Chrysaspis speciosa var. fastuosa
Chisognathus granti
Goliathus regius
Euchirus longimanus
Dynastes neptum
Goliathus giganteus
Lithinus nigrocristatus
Batocera ulma
B. armata

Ateuchus sacer
Entimus imperialis
Lamprina aurata
Plusiotus resplendens
Xyllorhiza adusta
Megosoma elephas
Golofa porteri
Euchroma gigantea
Dictyophorus reticulatus

Orthoptera (grasshoppers and walking sticks)

Giant cockroach
Phyllium siccifolium
Phryganistria fruehstorferi
Temera imperialis
Timanthes brunni
Giant grasshoppers
Gryllotalpa sp.

Riker mounts and life histories

Asta, large honey bee
Smaller, red wood ant
Trochilium apiformis
Arctia caja
Coccinella septempunctata
Dissosteira carolina
Periplaneta americana
Murgantia histrionica
Neoclytus erythrocephalus
Pelidnota punctata
Alsophila pometaria
Agrotis ypsilon
Melittia satyriniformis
Noctua c-nigrum
Bombus terricola
Cimbex americana

Exchange

Kuwana, Prof. S. I. Tokio, Japan

Aspidiotus bambusarum *Ckll.*
A. cryptomeriae *Kuw.*
A. paeoniae *Ckll.*
A. secreba *Ckll.*
Chionaspis bambusae *Ckll.*
C. citri *Comst.*
C. hikosani *Kuw.*
C. kiushiuensis *Kuw.*
Mytilaspis crawi *Ckll.*
M. uniloba *Kuw.*
Parlatoria ziziphus *Lucas*
Ischnaspis longirostria *Sign.*
Leucaspis japonica *Ckll.*
Pulvinaria citricola *Kuw.*
P. hazae *Kuw.*
P. horii *Kuw.*
P. idesiae *Kuw.*
P. oyamae *Kuw.*
P. photiniae *Kuw.*
Lecanium glandi *Kuw.*
L. kunoensis *Kuw.*
L. nishigaharae *Kuw.*
Aclerda tokionis *Ckll.*
Lecaniodiaspis quercus *Ckll.*
Ericerus pela *West.*
Eriococcus lagerstroemiae *Kuw.*
Antonia crawi *Ckll.*
Kermes vastus *Kuw.*
Takahashia japonica *Ckll.*
Icerya okodae *Kuw.* equals
I. seychellarum *West.*

Hardy, G. H. Tasmania

Prynus scutellaris *Fabr.*
Paropsis lineata *Marsh.*
P. serpiginosa *Er.*
P. nigerrima *Germ.*
Xanthophaea angustula *Chd.*
Trigonothrops longiplaga *Chd.*
Sarothrocrepis callida
Angonocheila curtula *Er.*
Natalis porcata *Fabr.*
Euchoptera apicalis *Saund.*
Lagria grandis *Gyllh.*
Haltica pagana *Bl.*
Adelium abreviatum *L.*

Johnson, C. W. Boston, Mass.

Odontomyia microstoma *Lw.*
Beris annulifera *Bigot.*
Scoliopelta luteipes *Will.*
Geosargus elegans *Lw.*
Hermetia illucens *Linn.*
Oxycera unifasciata *Lw.*
Nemotelus canadensis *Lw.*
N. unicolor *Lw.*
Chrysops sackeni *Hine*
C. delicatulus *O. S.*
C. montanus *O. S.*
C. pudicus *O. S.*
C. fallax *O. S.*
C. obsoletus *O. S.*
Platypalpus flavirostris *Lw.*
P. aequalis *Lw.*
Drapetis spectabilis *Melander*
Chersodromia houghi *Melander*
(Coloboneura)
Coloboneura inusitata *Melander*
Litanomyia elongata *Melander*
Hemerodromia scapularis *Lw.*
Clinocera simplex *Lw.*
Syneches rufus *Lw.*
Empis distans *Lw.*
E. humilis *Lw.*
E. tridentata *Coq.*
E. loripedis *Coq.*
E. obesa *Lw.*
E. spectabilis *Lw.*
Hilara tristis *Lw.*
H. umbrosa *Lw.*
Oreogeton obscura *Lw.*
Rhamphomyia candicans *Lw.*
R. irregularis *Lw.*
R. luteiventris *Lw.*
R. mutabilis *Lw.*
R. glabra *Lw.*
R. umbilicata *Lw.*
R. gracilis *Lw.*
R. pulla *Lw.*
Dolichopus palaestricus *Lw.*
Pelastoneura cognatus *Lw.*
Gymnopternus laevigatus *Lw.*
Argyra calcitrans *Lw.*
Hypocharassus pruinosus *Whlr.*
Hydrophorus aestuum *Lw.*
H. intentus *Aldrich*
H. chrysologus *Walk.*
Dichaetoneura leucoptera *Johns.*
Hypostena dunningii *Coq.*
H. floridensis *Town.*
Leskia analis *Say*
Exorista vulgaris *Fall.*
Sturmia inquinata *Vdw.*
Masicera festinans *Meign.*
Tachina simulans *Meign.*
Gonia senilis *Will.*
Epigrymyia floridensis *Town.*
Panzeria ruficauda *Brauer*
P. radicans *Fall.*
Peleteria aenea *Staeg.*
Melanophora roralis *Linn.*
Tetramerinx unica *Stein.*
Phyllogaster cordyluroides *Stein.*
Spilogaster pagana *Fabr.*
S. urbana *Meign.*
Limnophora diaphana *Weid.*
Fucillia marina *Macq.*
(Fucorum of authors not Fall.)
Rivellia quadrifasciata *Macq.*
Seoptera vibrans *Linn.*
Acidia fausta *O. S.*
Diastata vagans *Lw.*
Scyphella flava *Linn.*
Milichiella arcuata *Lw.*
Pholeomyia indecora *Lw.*
Agromyza posticata *Meign.*
(A. terminalis Coq. is a synonym according to Malloch)
A. parvicornis *Lw.*
A. melampyga *Lw.*
Dryomyza aristalis *Coq.*
Tetanocera setosa *Coq.*
Clusia lateralis *Walk.*
C. czernyi *Johns.*
Bittacomorpha jonesi *Johns.*

ZOOLOGY

Donation

Birds

Blaschke, F., Yonkers

Flicker, Colaptes auratus luteus Bangs..... 1
Chimney swift, Chaetura pelagica (Linnaeus)..... 1
Ruby-throated humming bird, Archilochus colubris (Linnaeus) 1
Crested flycatcher, Myiarchus crinitus (Linnaeus)..... 1
Blue jay, Cyanocitta cristata (Linnaeus)..... 1
Crow, Corvus brachyrhynchos Brehm..... 1
Starling, Sturnus vulgaris Linnaeus..... 1
Red-winged blackbird, Agelaius phoeniceus (Linnaeus).. 1
Baltimore oriole, Icterus galbula (Linnaeus)..... 2
Red crossbill, Loxia curvirostra minor (Brehm)..... 2
Goldfinch, Astragalinus tristis (Linnaeus)..... 2
Indigo bunting, Passerina cyanea (Linnaeus)..... 1
Yellow warbler, Dendroica aestiva (Gmelin)..... 3
Robin, Planesticus migratorius (Linnaeus)..... 1

Cummings, W. L., South Bethlehem, Pa.

Cape May warbler, Dendroica tigrina (Gmelin)..... 1

New York State Conservation Commission, Albany

Bobwhite, Colinus virginianus (Linnaeus)..... 1
Ring-necked pheasant, Phasianus torquatus Gmelin..... 1

Sanford, Dr L. C., New Haven, Conn.

Broad-winged hawk, Buteo platypterus (Vieillot)..... 1

Birds' eggs

Little, Miss E. W., Menands

Ostrich, Struthio camelus Linnaeus..... 1

Parker, A. C., Albany

Brown pelican, Pelecanus occidentalis Linnaeus..... 1

Reptile

Glynn, Governor Martin H., Albany

Snapping turtle, Chelydra serpentina (Linnaeus)..... 1

Fishes

New York State Conservation Commission, Albany

Banded pickerel, Lucius americanus (Gmelin)..... 2
Burbot, Lota maculosa (Le Sueur)..... 1

Wagoner, C. A., Troy

Gar pike, Psallisostomus osseus (Linnaeus)..... 1
Dogfish, Amia calva Linnaeus..... 2

Invertebrates

Portland Society of Natural History, Portland, Maine

Solemya borealis Totten..... 7

Bing, Dr W. A., Albany

Fish parasites, Ascaris clavata Rudolphi..... 4

Loaned by State Conservation Commission, Albany

Mounted mammal

Black bear, Ursus americanus Pallas..... 1

Mounted birds

Horned grebe, Colymbus auritus Linnaeus..... 3
Pied-billed grebe, Podilymbus podiceps (Linnaeus)..... 1
Loon, Gavia immer (Brünnich)..... 1
Black-throated loon, Gavia arctica (Linnaeus)..... 1
Red-throated loon, Gavia stellata (Pontoppidan)..... 1
Puffin, Fratercula arctica (Linnaeus)..... 1
Brünnich murre, Uria lomvia (Linnaeus)..... 2
Razor-billed auk, Alca torda (Linnaeus)..... 1
Dovekie, Alle alle (Linnaeus)..... 1
Parasitic jaeger, Stercorarius parasiticus (Linnaeus).. 1
Kittiwake, Rissa tridactyla (Linnaeus)..... 1
Glaucous gull, Larus hyperboreus Gunnerus..... 1
Herring gull, Larus argentatus Pontoppidan..... 3
Ring-billed gull, Larus delawarensis Ord..... 1
Laughing gull, Larus atricilla Linnaeus..... 1
Bonaparte gull, Larus philadelphia (Ord)..... 2
Gull-billed tern, Gelochelidon nilotica (Linnaeus)..... 1
Common tern, Sterna hirundo Linnaeus..... 1
Arctic tern, Sterna paradisea Brünnich..... 1
Black tern, Hydrochelidon nigra surinamensis (Gmelin) 2
Black skimmer, Rynchops nigra Linnaeus..... 1
Sooty shearwater, Puffinus griseus (Gmelin)..... 1
Black-capped petrel, Aestrelata hasitata (Kuhl)..... 1
Leach petrel, Oceanodroma leucorhoa (Vieillot)..... 1
Wilson petrel, Oceanites oceanicus (Kuhl)..... 1
Gannet, Sula bassana (Linnaeus)..... 1
Common cormorant, Phalacrocorax carbo (Linnaeus).... 1
Double-crested cormorant, Phalacrocorax auritus (Lesson) 1
Brown pelican, Pelecanus occidentalis Linnaeus..... 1
American merganser, Mergus americanus Cassin..... 2
Red-breasted merganser, Mergus serrator Linnaeus..... 2
Hooded merganser, Lophodytes cucullatus (Linnaeus).. 2
Mallard, Anas playtyrhynchos Linnaeus..... 2
Black duck, Anas rubripes Brewster..... 2
Baldpate, Mareca americana (Gmelin)..... 2
Green-winged teal, Nettion carolinense (Gmelin)..... 2
Blue-winged teal, Querquedula discors (Linnaeus)..... 2
Shoveler, Spatula clypeata (Linnaeus)..... 1
Pintail, Dafila acuta (Linnaeus)..... 2

Wood duck, Aix sponsa (Linnaeus)..... 2
Redhead, Marila americana (Eyton)..... 1
Canvasback, Marila valisineria (Wilson)..... 2
Greater scaup duck, Marila marila (Linnaeus)..... 1
Lesser scaup duck, Marila affinis (Eyton)..... 2
Golden-eye, Clangula clangula americana Bonaparte.. 1
Buffle-head, Charitonetta albeola (Linnaeus)..... 1
Old squaw, Harelda hyemalis (Linnaeus)..... 3
Harlequin duck, Histrionicus histrionicus (Linnaeus). 1
American eider, Somateria dresseri Sharpe..... 1
King eider, Somateria spectabilis (Linnaeus)..... 1
American scoter, Oidemia americana Swainson..... 1
White-winged scoter, Oidemia deglandi Bonaparte..... 1
Surf scoter, Oidemia perspicillata (Linnaeus)..... 1
Ruddy duck, Erismatura jamaicensis (Gmelin)..... 2
Greater snow goose, Chen hyperboreus nivalis (Forster). 2
White-fronted goose, Anser albifrons gambeli Hartlaub. 1
Canada goose, Branta canadensis (Linnaeus)..... 1
Whistling swan, Olor columbianus (Ord)..... 1
Bittern, Botaurus lentiginosus (Montague)..... 1
Least bittern, Ixobrychus exilis (Gmelin)..... 1
Egret, Herodias egretta (Gmelin)..... 1
Little blue heron, Florida caerulea (Linnaeus)..... 1
Green heron, Butorides virescens (Linnaeus)..... 1
Black-crowned night heron, Nycticorax nycticorax naevius (Boddaert)..... 1
Yellow-crowned night heron, Nyctanassa violacea (Linnaeus) 1
King rail, Rallus elegans Audobon..... 1
Clapper rail, Rallus crepitans Gmelin..... 1
Sora, Porzana carolina (Linnaeus)..... 1
Yellow rail, Coturnicops noveboracensis (Gmelin)... 1
Purple gallinule, Ionornis martinicus (Linnaeus)..... 1
Florida gallinule, Gallinula galeata (Lichtenstein)..... 2
Coot, Fulica americana Gmelin..... 1
Northern phalarope, Lobipes lobatus (Linnaeus)..... 1
Wilson phalarope, Steganopus tricolor Vieillot..... 1
Avocet, Recurvirostra americana Gmelin..... 1
Woodcock, Philohela minor (Gmelin)..... 2
Wilson snipe, Gallinago delicata (Ord)..... 1
Dowitcher, Macrorhamphus griseus (Gmelin)..... 1
Long-billed dowitcher, Macrorhamphus griseus scolopaceus (Say)..... 1
Knot, Tringa canutus (Linnaeus)..... 1
Purple sandpiper, Arquatella maritima (Brünnich)..... 2
Pectoral sandpiper, Pisobia maculata (Vieillot)..... 1
White-rumped sandpiper, Pisobia fuscicollis (Vieillot)... 1
Baird sandpiper, Pisobia bairdi (Coues)..... 1
Least sandpiper, Pisobia minutilla (Vieillot)..... 1
Red-backed sandpiper, Pelidna alpina sakhalina (Vieillot) 1

Sanderling, Calidris leucophaea (Pallas)..... 1
Marbled godwit, Limosa fedoa (Linnaeus)..... 1
Greater yellow-legs, Totanus melanoleucus (Gmelin)... 2
Solitary sandpiper, Totanus flavipes (Gmelin)..... 1
Willet, Catoptrophorus semipalmatus (Gmelin)..... 2
Upland plover, Bartramia longicauda (Bechstein)..... 1
Spotted sandpiper, Actitis macularia (Linnaeus)..... 1
Long-billed curlew, Numenius americanus Bechstein.... 1
Hudsonian curlew, Numenius hudsonicus Latham..... 1
Black-bellied plover, Squatarola squatarola (Linnaeus).. 1
Golden plover, Charadrius dominicus Müller..... 1
Killdear plover, Oxyechus vociferus (Linnaeus)..... 1
Semipalmated plover, Aegialitis semipalmata (Bonaparte). 1
Piping plover, Aegialitis meloda (Ord)..... 1
Wilson plover, Ochthodromus wilsonius..... 1
Turnstone, Arenaria interpres morinella (Linnaeus). 1
Oyster-catcher, Haematopus palliatus Temminck..... 1
Bob-white, Colinus virginianus (Linnaeus)..... 2
Canada grouse, Canachites canadensis canace (Linnaeus) 2
Ruffed grouse, Bonasa umbellus (Linnaeus)..... 3
Ring-necked pheasant, Phasianus torquatus Gmelin..... 4
Hungarian partridge, Perdix cinerea Linnaeus..... 4
Mourning dove, Zenaidura macroura carolinensis (Linnaeus) 1
Sharp-shinned hawk, Accipiter velox (Wilson)..... 1
Cooper hawk, Accipiter cooperi (Bonaparte)..... 2
Red-tailed hawk, Buteo borealis (Gmelin)..... 1
Rough-legged hawk, Archibuteo lagopus sancti-johannis (Gmelin)..... 1
Bald eagle, Haliaeetus leucocephalus (Linnaeus)..... 1
Duck hawk, Falco peregrinus anatum Bonaparte..... 1
Pigeon hawk, Falco columbarius Linnaeus..... 1
Sparrow hawk, Falco sparverius Linnaeus..... 2
Osprey, Pandion haliaëtus carolinensis (Gmelin).. 1
Long-eared owl, Asio wilsonianus (Lesson)..... 1
Great gray owl, Scotiaptex nebulosa (Foster)..... 1
Richardson owl, Cryptoglaux funerea richardsoni (Bonaparte) 1
Saw-whet owl, Cryptoglaux acadica (Gmelin)..... 2
Screech owl, Otus asio (Linnaeus)..... 1
Snowy owl, Nyctea nyctea (Linnaeus)..... 1
Yellow-billed cuckoo, Coccyzus americanus (Linnaeus).. 1
Black-billed cuckoo, Coccyzus erythrophthalmus (Wilson) 1
Belted kingfisher, Ceryle alcyon (Linnaeus)..... 1
Hairy woodpecker, Dryobates villosus (Linnaeus)..... 1
Downy woodpecker, Dryobates pubescens (Linnaeus).... 1
Arctic three-toed woodpecker, Picoides arcticus (Swainson). 2
Yellow-bellied sapsucker, Sphyrapicus varius (Linnaeus).. 1

Pileated woodpecker, Phloeotomus principalis abieticola (Bangs) 1
Red-headed woodpecker, Melanerpes erythrocephalus (Linnaeus) 1
Red-bellied woodpecker, Centurus carolinus (Linnaeus).. 1
Flicker, Colaptes auratus luteus Bangs..... 1
Whip-poor-will, Antrostomus vociferus (Wilson)..... 1
Night hawk, Chordeiles virginianus (Gmelin)..... 1
Chimney swift, Chaetura pelagica (Linnaeus)..... 1
Ruby-throated hummingbird, Archilochus colubris (Linnaeus) 1
Kingbird, Tyrannus tyrannus (Linnaeus)..... 1
Phoebe, Sayornis phoebe (Latham)..... 2
Olive-sided flycatcher, Nuttallornis borealis (Swainson). 1
Yellow-bellied flycatcher, Empidonax flaviventris (Baird) 1
Green-crested flycatcher, Empidonax virescens (Vieillot). 1
Alder flycatcher, Empidonax trailli alnorum (Brewster). 1
Least flycatcher, Empidonax minimus (Baird)..... 2
Horned lark, Otocoris alpestris (Linnaeus)..... 1
Prairie horned lark, Otocoris alpestris praticola Henshaw 2
Blue jay, Cyanocitta cristata (Linnaeus)..... 2
Canada jay, Perisoreus canadensis (Linnaeus)..... 1
Raven, Corvus corax principalis Ridgway..... 1
Crow, Corvus brachyrhynchos Brehm..... 1
Starling, Sturnus vulgaris Linnaeus..... 2
Bobolink, Dolichonyx oryzivorus (Linnaeus)..... 1
Cowbird, Molothrus ater (Boddaert)..... 1
Red-winged blackbird, Agelaius phoeniceus (Linnaeus).. 1
Meadowlark, Sturnella magna (Linnaeus)..... 1
Baltimore oriole, Icterus galbula (Linnaeus)..... 1
Rusty blackbird, Euphagus carolinus (Müller)..... 1
Purple grackle, Quiscalus quiscula quiscula (Linnaeus) 1
Bronzed grackle, Quiscalus quiscula aeneus Ridgway.. 1
Pine grosbeak, Pinicola enucleator leucura (Müller).. 2
English sparrow, Passer domesticus (Linnaeus)..... 1
Purple finch, Carpodacus purpureus (Gmelin)..... 1
American crossbill, Loxia curvirostra minor (Brehm).. 2
White-winged crossbill, Loxia leucoptera Gmelin..... 1
Redpoll, Acanthis linaria (Linnaeus)..... 1
American goldfinch, Astragalinus tristis (Linnaeus)..... 1
Pine siskin, Spinus pinus (Wilson)..... 2
European goldfinch, Carduelis elegans (Linnaeus)..... 1
Snow bunting, Plectrophenax nivalis (Linnaeus)..... 2
Lapland longspur, Calcarius lapponicus (Linnaeus)..... 1
Vesper sparrow, Pooecetes gramineus (Gmelin)..... 1
Savannah sparrow, Passerculus sandwichensis savanna (Wilson)..... 1
Grasshopper sparrow, Ammodramus savannarum australis Maynard 1
Henslow sparrow, Passerherbulus henslowi (Audubon). 1

Sharp-tailed sparrow, Passerherbulus caudacutus (Gmelin) 1
White-throated sparrow, Zonotrichia albicollis (Gmelin).
Tree sparrow, Spizella monticola (Gmelin)..... 1
Chipping sparrow, Spizella passerina (Bechstein)..... 1
Field sparrow, Spizella pusilla (Wilson)..... 2
Lincoln sparrow, Melospiza lincolni (Audubon)..... 1
Fox sparrow, Passerella iliaca (Merrem)..... 2
Towhee, Pipilo erythrophthalmus (Linnaeus)..... 1
Cardinal, Cardinalis cardinalis (Linnaeus)..... 1
Rose-breasted grosbeak, Zamelodia ludoviciana (Linnaeus) 1
Purple martin, Progne subis (Linnaeus)..... 1
Cliff swallow, Petrochelidon lunifrons (Say)..... 1
Bohemian waxwing, Bombycilla garrula (Linnaeus)..... 1
Cedar waxwing, Bombycilla cedrorum Vieillot..... 2
Northern shrike, Lanius borealis Vieillot..... 1
Migrant shrike, Lanius ludovicianus migrans Palmer. 1
Red-eyed vireo, Vireosylva olivacea (Linnaeus)..... 1
Philadelphia vireo, Vireosylva philadelphica Cassin... 1
Black and white warbler, Mniotilta varia (Linnaeus)..... 1
Prothonotary warbler, Protonotaria citrea (Boddaert).... 1
Worm-eating warbler, Helmitheros vermivorus (Gmelin) 1
Blue-winged warbler, Vermivora pinus (Linnaeus)..... 1
Golden-winged warbler, Vermivora chrysoptera (Linnaeus) 1
Parula warbler, Compsothlypis americana usneae Brewster 1
Yellow warbler, Dendroica aestiva (Gmelin)..... 1
Black-throated blue warbler, Dendroica caerulescens (Gmelin) 1
Myrtle warbler, Dendroica coronata (Linnaeus)..... 1
Chestnut-sided warbler, Dendroica pensylvanica (Linnaeus) 1
Bay-breasted warbler, Dendroica castanea (Wilson)..... 1
Black-pool warbler, Dendroica striata (Forster)..... 1
Blackburnian warbler, Dendroica fusca (Müller)..... 1
Black-throated green warbler, Dendroica virens (Gmelin).. 1
Palm warbler, Dendroica vigorsi (Audubon)..... 1
Yellow palm warbler, Dendroica palmarum hypochrysea Ridgway 1
Oven bird, Seiurus aurocapillus (Linnaeus)..... 1
Water thrush, Seiurus noveboracensis (Gmelin)..... 1
Louisiana water thrush, Seiurus motacilla (Vieillot)..... 1
Kentucky warbler, Oporornis formosus (Wilson)..... 1
Connecticut warbler, Oporornis agilis (Wilson)..... 1
Mourning warbler, Oporornis philadelphia (Wilson).... 1
Maryland yellow-throat, Geothlypis trichas (Linnaeus).. 1
Yellow-breasted chat, Icteria virens (Linnaeus)..... 1

Hooded warbler, Wilsonia citrina (Boddaert)..... 2
Wilson warbler, Wilsonia pusilla (Wilson)..... 1
Canadian warbler, Wilsonia canadensis (Linnaeus)..... 1
Redstart, Setophaga ruticilla (Linnaeus)..... 1
American pipit, Anthus rubescens (Tunstall)..... 1
Mockingbird, Mimus polyglottos (Linnaeus)..... 1
Catbird, Dumetella carolinensis (Linnaeus)..... 1
Brown thrasher, Toxostoma rufum (Linnaeus)..... 1
Carolina wren, Thryothorus ludovicianus (Latham)... 1
Winter wren, Nannus hiemalis (Vieillot)..... 1
White-breasted nuthatch, Sitta carolinensis Latham..... 2
Red-breasted nuthatch, Sitta canadensis Linnaeus..... 1
Brown-headed nuthatch, Sitta pusilla Latham..... 1
Chickadee, Penthestes atricapillus (Linnaeus)..... 1
Hudsonian chickadee, Penthestes hudsonicus (Forster).. 1
Golden-crowned kinglet, Regulus satrapa Lichtenstein..... 1
Wood thrush, Hylocichla mustelina (Gmelin)..... 1
Olive-backed thrush, Hylocichla ustulata swainsoni (Tschudi) 1
Hermit thrush, Hylocichla guttata pallasi (Cabanis).. 1
Robin, Planesticus migratorius (Linnaeus)..... 1
Bluebird, Sialia sialis (Linnaeus)..... 1

Mounted fishes

Sea lamprey, Petromyzon marinus Linnaeus..... 1
Common sturgeon, Acipenser sturio Linnaeus..... 1
Short-nosed sturgeon, Acipenser brevirostrum Le Sueur. 1
Gar pike, Psallisostomus osseus (Linnaeus)..... 1
Bowfin, Amia calva Linnaeus..... 1
Bullhead, Ameiurus nebulosus (Le Sueur)..... 1
Long-nosed sucker, Catostomus catostomus (Forster).. 1
Common sucker, Catostomus commersonii (Lacepede).. 2
Hog sucker, Catostomus nigricans Le Sueur..... 1
Red horse sucker, Moxostoma aureolum (Le Sueur)..... 1
Fallfish, Semotilus bullaris (Rafinesque)..... 1
Carp, Cyprinus carpio Linnaeus..... 1
Common eel, Anguilla chrispa Rafinesque..... 2
Conger eel, Leptocephalus conger (Linnaeus)..... 1
Herring, Clupea harengus Linnaeus..... 1
Hickory shad, Pomolobus mediocris (Mitchill)..... 1
Alewife, Pomolobus pseudoharengus (Wilson)..... 1
Shad, Alosa sapidissima (Wilson)..... 1
Menhaden, Brevoortia tyrannus (Latrobe)..... 1
Round whitefish, Coregonus quadrilateralis Richardson. 1
Common whitefish, Coregonus clupeiformis (Mitchill).. 1
Atlantic salmon, Salmo salar Linnaeus..... 1
Red-throat trout, Salmo henshawi Gill & Jordan..... 1
Brown trout, Salmo fario Linnaeus..... 2
Rainbow trout, Salmo irideus Gibbons..... 2
Hybrid trout, Salmo fario + Salvelinus fontinalis... 1
Lake trout, Cristivomer namaycush (Walbaum)..... 3

Brook trout, Salvelinus fontinalis (Mitchill)..... 5
Grayling, Thymallus montanus (Milner)..... 1
Smelt, Osmerus mordax (Mitchill)..... 1
Banded pickerel, Lucius americanus (Gmelin)..... 1
Common pickerel, Lucius reticulatus (Le Sueur)..... 2
Pike, Lucius lucius (Linnaeus)..... 2
Muskellunge, Lucius masquinongy (Mitchill)..... 1
Chautauqua muskellunge, Lucius ohiensis Kirtland..... 1
Mullet, Mugil cephalus Linnaeus..... 1
Mackerel, Scomber scombrus Linnaeus..... 1
Bonito, Sarda sarda (Bloch)..... 1
Spanish mackerel, Scomberomorus maculatus (Mitchill). 1
Cutlass fish, Trichiurus lepturus Linnaeus..... 1
Pompano, Trachinotus carolinus (Linnaeus)..... 1
Bluefish, Pomatomus saltatrix (Linnaeus)..... 1
Butterfish, Poronotus triacanthus (Peck)..... 1
Crappie, Pomoxis annularis Rafinesque..... 1
Calico bass, Pomoxis sparoides (Lacépède)..... 1
Rock bass, Ambloplites rupestris (Rafinesque)..... 1
Common sunfish, Eupomotis gibbosus (Linnaeus)..... 1
Small-mouthed black bass, Micropterus dolomieu Lacépède 1
Large-mouthed black bass, Micropterus salmoides Lacépède 2
Wall-eyed pike, Stizostedion vitreum (Mitchill)..... 3
Gray sand pike, Stizostedion canadense griseum (DeKay) 1
Yellow perch, Perca flavescens (Mitchill)..... 2
White bass, Roccus chrysops (Rafinesque)..... 1
Striped bass, Roccus lineatus (Bloch)..... 1
White perch, Morone americana (Gmelin)..... 1
Sea bass, Centropristes striatus Linnaeus..... 1
Red snapper, Lutianus blackfordii Goode & Bean..... 1
Porgy, Stenotomus chrysops (Linnaeus)..... 1
Sheepshead, Archosargus probatocephalus (Walbaum). 1
Weakfish, Cynoscion regalis (Bloch & Schneider)..... 1
Sea trout, Cynoscion nebulosus (Cuvier & Valenciennes). 1
Red drumfish, Sciaenops ocellatus (Linnaeus)..... 2
Croaker, Micropogon undulatus (Linnaeus)..... 1
Kingfish, Menticirrhus saxatilis (Bloch & Schneider).. 1
Cunner, Tautogolabrus adspersus (Walbaum)..... 1
Blackfish, Tautoga onitis (Linnaeus)..... 1
Spadefish, Chaetodipterus faber (Broussonet)..... 1
Rosefish, Sebastes marinus Linnaeus..... 1
Scalpin, Myoxocephalus octodecimspinosus (Mitchill) 1
Sea raven, Hemitripterus americanus (Gmelin)..... 1
Lump sucker, Cyclopterus lumpus Linnaeus..... 1
Wolf fish, Anarhichas lupus Linnaeus..... 1
Eel pout, Zoarces anguillaris (Peck)..... 1
Shark sucker, Echeneis naucrates Linnaeus..... 1

Whiting, Merlucius bilinearis (Mitchill)..... 1
Pollack, Pollachius virens (Linnaeus)..... 1
Frost fish, Microgadus tomcod (Walbaum)..... 1
Codfish, Gadus callarias Linnaeus..... 1
Haddock, Melanogrammus aeglefinus (Linnaeus)..... 1
Burbot, Lota maculosa (Le Sueur)..... 1
Spotted hake, Phycis regius (Walbaum)..... 1
Squirrel hake, Phycis chuss (Walbaum)..... 1
Cusk, Brosme brosme (Müller)..... 1
Halibut, Hippoglossus hippoglossus (Linnaeus)..... 1
Rough dab, Hippoglossoides platessoides (Fabricus). 1
Summer flounder, Paralichthys dentatus (Linnaeus).... 1
Winter flounder, Pseudopleuronectes americanus (Walbaum) 1

Purchase

Mammals

Elliott, J. C. East Greenbush

Gray fox, Urocyon cinereoargentatus (Schreber).... 1

Hartley, B. M. West Haven, Conn.

Woodchuck, Marmota monax (Linnaeus)..... 2

Birds (mounted)

Barker, Fred. Parker's Prairie, Minn.

Pied-billed grebe, Podilymbus podiceps (Linnaeus)..... 3
Loon, Gavia immer (Brünnich)..... 1
Herring gull, Larus argentatus Pontoppidan..... 1
Ring-billed gull, Larus delawarensis Ord..... 1
Bonaparte gull, Larus philadelphia (Ord)..... 1
Mallard, Anas platyrhynchos Linnaeus..... 1
Cinnamon teal, Querquedula cyanoptera (Vieillot).... 2
Redhead, Marila americana (Eyton)..... 2
Greater scaup duck, Marila marila (Linnaeus)..... 1
Lesser scaup duck, Marila affinis (Eyton)..... 1
White-winged scoter, Oidemia deglandi Bonaparte..... 3
Surf scoter, Oidemia perspicillata (Linnaeus)..... 3
Black rail, Creciscus jamaicensis (Gmelin)..... 1
Coot, Fulica americana Gmelin..... 1
Black-necked stilt, Himantopus mexicanus (Müller).... 2
Woodcock, Philohela minor (Gmelin)..... 1
Knot, Tringa canutus Linnaeus..... 1
Sanderling, Calidris leucophaea (Pallas)..... 1
Marbled godwit, Limosa fedoa (Linnaeus)..... 2
Hudsonian godwit, Limosa haemastica (Linnaeus)..... 1
Greater yellowlegs, Totanus melanoleucus (Gmelin).... 1
Hudsonia curlew, Numenius hudsonicus Latham..... 1
Bobwhite, Colinus virginianus (Linnaeus)..... 2
Marsh hawk, Circus hudsonius (Linnaeus)..... 3

Cooper hawk, Accipiter cooperi (Bonaparte)..... 1
Goshawk, Astur atricapillus (Wilson)..... 1
Red-tailed hawk, Buteo borealis (Gmelin)..... 1
Swainson hawk, Buteo swainsoni Bonaparte..... 1
Great gray owl, Scotiaptex nebulosa (Forster)..... 1
Hawk owl, Surnia ulula caparoch (Müller)..... 1
Burrowing owl, Speotyto cunicularia hypogaea (Bonaparte) 2
Black-billed cuckoo, Coccyzus erythrophthalmus (Wilson) 2
Kingfisher, Ceryle alcyon (Linnaeus)..... 2
Hairy woodpecker, Dryobates villosus (Linnaeus)..... 1
Red-headed woodpecker, Melanerpes erythrocephalus (Linnaeus) 1
Red-bellied woodpecker, Centurus carolinus (Linnaeus)... 2
Night hawk, Chordeiles virginianus (Gmelin)..... 1
Chimney swift, Chaetura pelagica (Linnaeus)..... 1
Kingbird, Tyrannus tyrannus (Linnaeus)..... 2
Arkansas kingbird, Tyrannus verticalis Say..... 1
Horned lark, Otocoris alpestris (Linnaeus)..... 2
Magpipe, Pica pica hudsonia (Sabine)..... 1
Bobolink, Dolichonyx oryzivorus (Linnaeus)..... 1
Yellow-headed blackbird, Xanthocephalus xanthocephalus (Bonaparte)..... 2
Red-winged blackbird, Agelaius phoeniceus (Linnaeus)... 1
Baltimore oriole, Icterus galbula (Linnaeus)..... 2
Bullock oriole, Icterus bullocki (Swainson)..... 1
Rusty blackbird, Euphagus carolinus (Müller)..... 2
Bronzed grackle, Quiscalus quiscula aeneus Ridgway.. 3
Evening grosbeak, Hesperiphona vespertina (Cooper). 1
Pine grosbeak, Pinicola enucleator leucura (Müller). 1
Purple finch, Carpodacus purpureus (Gmelin)..... 2
American crossbill, Loxia curvirostra minor (Brehm).. 3
White-winged crossbill, Loxia leucoptera Gmelin..... 1
Hoary redpoll, Acanthis hornemanni exilipes (Coues). 4
Redpoll, Acanthis linaria (Linnaeus)..... 3
Goldfinch, Astragalinus tristis (Linnaeus)..... 1
Snow bunting, Plectrophenax nivalis (Linnaeus)..... 2
Lapland longspur, Calcarius lapponicus (Linnaeus)..... 2
Savannah sparrow, Passerculus sandwichensis savanna (Wilson)..... 1
Leconte sparrow, Passerherbulus lecontei Audubon.... 2
Lark sparrow, Chondestes grammacus (Say)..... 1
White-throated sparrow, Zonotrichia albicollis (Gmelin). 2
Swamp sparrow, Melospiza georgiana (Latham)..... 2
Cardinal grosbeak, Cardinalis cardinalis (Linnaeus).... 1
Blue grosbeak, Guiraca caerulea (Linnaeus)..... 1
Indigo bunting, Passerina cyanea (Linnaeus)..... 1
Lark bunting, Calamospiza melanocorys Stejneger.... 1
Louisiana tanager, Piranga ludoviciana (Wilson)..... 1
Barn swallow, Hirundo erythrogastra Boddaert..... 2

Bohemian waxwing, Bombycilla garrula (Linnaeus)..... 1
Cedar waxwing, Bombycilla cedrorum Vieillot..... 1
Warbling vireo, Vireosylva gilva (Vieillot)..... 1
Black and white warbler, Mniotilta varia (Linnaeus)..... 1
Tennessee warbler, Vermivora peregrina (Wilson)..... 1
Cape May warbler, Dendroica tigrina (Gmelin)..... 1
Yellow warbler, Dendroica aestiva (Gmelin)..... 1
Magnolia warbler, Dendroica magnolia (Wilson)..... 2
Bay-breasted warbler, Dendroica castanea (Wilson)..... 1
Blackburnian warbler, Dendroica fusca (Müller)..... 2
Water thrush, Seiurus noveboracensis (Gmelin)..... 2
Wilson warbler, Wilsoni pusilla (Wilson)..... 1
Redstart, Setophaga ruticilla (Linnaeus)..... 2
Catbird, Dumetella carolinensis (Linnaeus)..... 1
House wren, Troglodytes aedon (Vieillot)..... 2
Short-billed marsh wren, Cistothorus stellaris (Naumann) 2
Long-billed marsh wren, Telmatodytes palustris (Wilson) 1
Golden-crowned kinglet, Regulus satrapa Lichtenstein..... 1
Ruby-crowned kinglet, Regulus calendula (Linnaeus)..... 1
Olive-backed thrush, Hylocichla ustulata swainsoni (Tschudi) 3
Robin, Planesticus migratorius (Linnaeus)..... 2
Varied thrush, Ixoreus naevius (Gmelin)..... 1
Bluebird, Sialia sialis (Linnaeus)..... 1

Marsters, C. E. Albany

Ruffed grouse, Bonasa umbellus (Linnaeus)..... 1

Amphibians (casts)

Franklin, Dwight. New York City

Spotted salamander, Ambystoma punctatum (Linnaeus).. 1
Tiger salamander, Ambystoma tigrinum Green..... 1
Red salamander, Spelerpes ruber (Daudin)..... 1
Spade-foot toad, Scaphiopus holbrooki (Harlan)..... 1
Spring peeper, Hyla pickeringii Storer..... 1
Leopard frog, Rana pipiens Schreber..... 1
Pickerel frog, Rana palustris Le Conte..... 1
Green frog, Rana clamata Dandin..... 1
Bull frog, Rana catesbeiana Shaw..... 1
Wood frog, Rana sylvatica Le Conte..... 1

CONCEPTIONS REGARDING THE AMERICAN DEVONIC[1]

BY JOHN M. CLARKE

This theme has seemed to me appropriate to the present occasion because, primarily, of Professor Kayser's positive influence upon the accepted interpretation of the Devonic system in the Western Hemisphere and, in a broader sense, for his long and intimate concern with the various aspects of this great period in the history of the earth.

It is thirty-six years since the publication of Kayser's important treatise on the Lowest Devonic Formations of the Hartz Mountains, and this, more than any other single work, inaugurated a reconstruction of ideas concerning the scope of the Devonic system; in so doing, it created new problems and inspired investigations into a wider field. Thirty-six years ago the writer of this paper, truly a native of the Devonic, was fresh from college and full of enthusiasm over the study of this formation. Throughout the stretch of years since then, both have labored continuously over the Devonic problems, for much of the time in close and sympathetic touch, the younger man receiving from the elder, in information, suggestion and inspiration, debts which can be repaid only in service to a common science.

The State of New York, which has been the writer's port of departure into this field, is very properly designated a Devonic state, for more than one-half its area is covered by the rocks of the period, and the succession of its members from base to summit comprises a record whose pages are almost intact and effectively illustrate the variant happenings of the time. In America we were long in the way of endeavoring to square all the Paleozoic formations of the country with the New York standard column. The work of the founders of the "New York Series of Formations" in establishing their classification, nearly seventy-five years ago, was well done, but the amplification of our knowledge has now clearly shown that in all elements of the Paleozoic except the Devonic (the Cambric, Lower and Upper Siluric and Carbonic), the New

[1] The distinguished career in geological science of Professor Emanuel Kayser of Marburg was to have been specially celebrated on his seventieth birthday, 1915, by the publication of a *Festschrift* of essays by his colleagues and students. For this purpose and occasion the essay here given was prepared.

York record is imperfect, both in sedimentation and in life; not from extensive erosive destruction, but from minor diastrophies and unfavorable geography. But the same growth of knowledge has fortified the standard New York Devonic section as thoroughly complete and indicial, lacking in no essential detail in quality of development, presenting in some degree at least all the phases of the system as exhibited in its transcontinental development, however these phases may vary in magnitude from great to small.

It is within reason and accuracy, then, to say that not in Devonshire nor in the Rhineland, not in the Urals nor in Siberia, not on the Bosporus or in South Africa, not in the basin of the Amazon, of the La Plata or in the Andean Cordilleras, is the full and variant succession of Devonic events so well recorded or at least so clearly and simply presented, and perhaps so fully known, as in New York. Upon this stage the successive scenes of the great drama were set without serious intermission and the players made their exits and their entrances till the curtain fell.

The panorama of development in Devonic geography and life here set forth has justified the arduous years of labor spent upon its elucidation. The efforts made to turn upon the New York record every ray of light that any other part of the earth could contribute have served to establish its integrity and to fortify it as the ideal monument of Devonic history; while, in its turn, it has responded like a Rosetta Stone, in helping to decipher the significance of the fragmentary and less known. Its problems are as many as the growing host of students which later years have drawn to their solution, but there are some of general import bearing broadly upon the interpretation of the system as a whole to which it is here designed to make special allusion.

I THE LOWER BOUNDARY

The limestone faunas. The problem of the base of the system never became a matter of serious question until brought into the foreground by Professor Kayser's proposition that the limestone faunas of the northern Hartz and the F, G, H stages of Bohemia, which had passed as Upper Siluric, were logically and more appropriately to be regarded as a deeper water facies of the early Devonic seas. In presenting the broader correlations which resulted from his discussion of the general theme, Kayser included with the equivalents of these misinterpreted lower Devonic lime faunas, the "Lower Helderberg" formation of New York and its various subdivisions. Just here was the entering wedge for the American problem. Soon Tschernyschew in the Urals, Barrois in the Asturias

and northern France, added confirmatory evidence for the new interpretation, but still Kayser's correlation for the "Lower Helderberg" of New York remained obviously based on literature only. In those days an intimation of this kind coming from Germany to America, for the time being was lost. Under the best of conditions it takes years for the suggestion of a foreign literature to percolate into the counsels of the coworker in a different language. In 1878 and those years, few American geologists of influence knew anything about the German language or of German geology, and Kayser's suggestions, so far as New York was concerned, fell on dull ears. Ten years passed before the evidence of the Devonic age of the Helderberg formation was summarized in detail and set forth in a New York publication, and even then it was presented in tentative form. The writer was responsible for this presentation. His chief in the geological service of New York, the distinguished James Hall, was so absolutely hostile to the suggested interpretation that, in order to even secure publication for this array of evidence, it became necessary to change a positive argument into a neutral statement of facts and all conclusions into queries. But for New York and America the "Hercyn-frage" became the "Helderberg question," thenceforth quietly but effectively argued with intensive massing of the facts, in which a strong part was taken by Schuchert, until in 1908, twenty years after the effective proposition was made, the Helderberg formation with the profuse lime-faunas of all its subdivisions save that at the base, was formally incorporated into the Devonic, in a revision of the New York classification by Mr Schuchert and the writer; and there it seems likely to remain.

The embarrassments which involved the acceptance of this apparently simple proposition were, in actual structure and fact, more weighty in effect than was the widespread and outspoken antagonism in Europe to Kayser's proposition. Here there were few parties of interest and here the succession from the Siluric upward was unbroken, either by erosion or disconformity.

In both countries the abstraction of the Helderberg equivalents meant a paring down of the Murchisonian conception of the Siluric, which, through Murchison's personal intervention, had been deeply engrafted on Hall's construction of the Siluric here. This procedure was of serious import, and a consequence has been, for New York anyway, a reduction of the Siluric (Upper Siluric) to its lowest terms, that is to say, practically a reduction to its Wenlock equivalent (Niagaran), supplemented below by heavy local sands, and above by local developments due to the peculiar geography which

made and unmade the Salina sea. The particular aspect of the problem regarding the base of the Devonic that we are now considering has a somewhat localized significance in America, for the lime sediments of this time, with their rich faunas, are quite essentially (though not exclusively) of Appalachian origin. Throughout the great stretch of the Appalachians from southwest to northeast, the Helderberg seems only very gradually to become disentangled from its Siluric affiliations. In the State of Maryland a great mass of lime-clay sedimentation (Keyser member) lies at the base of the Helderberg members as developed in New York. There it embraces the maximum sedimentation of the lime seas stage and its fossils have but partly disentangled themselves from Siluric connections. In New York the place of this formation is held by lime units which fail to carry the Helderberg fauna and are therefore excluded from that formation. In Gaspé bay, on the other hand, in the far northeast Appalachians of lower Quebec (and probably in the extensively altered regions between New York and there), the discordance between the Helderberg and the Siluric is absolute, profound and fundamental. There the Siluric failed entirely or has been ground out by overthrust. Farther south in Gaspé, conformity is resumed in strata standing at extreme angles, but here, at Percé and in the head of the Bay Chaleur at Dalhousie, the aspect of the correlative lime sediments changes, and in places a large element of Atlantic species is introduced into the fauna and we are no longer dealing with like quantities.

The sandstone transgression. It is well understood that the shallow water transgression of the early Devonic was vast in its amplitude. At no level in the Paleozoic column is the overriding of the former shore lines by the shallow marine waters so emphatically marked. This extraordinary transgression resulting from a slight but almost universal negative diastrophy, spread over the earth a fauna of large proportions and homogeneous character, in great part a derivative from the deeper lime sediments of the contemporaneous sea, but always an adjunct of the spreading shallow waters. As the transgression proceeded, it carried with it species out of their normal development basins into others where they never became climacteric or elemental, but stand today as a key to the fact and the direction of their migration. It has been thought that with the close of the Siluric the great Arctic bay which reached down into the interior of the continent had become largely obliterated, but this contraction seems to have been essentially at the south and the northward and westward transgression over the north Atlantic

lands of Laurentia from the bays of southern England, Belgium and the Rhine brought into the embayments of the eastern Appalachian rias, in Maine, in Nova Scotia and New Brunswick, percentages of Coblentzian species quite foreign to the sandstone or Oriskany fauna as it was normally developed in our interior sea. The presence of these Coblentzian species in Atlantic lands is itself another confirmatory evidence of the upstanding and overridden land bridge across the north Atlantic continuing onward from early Cambric time into the final and continental phases of Devonic sedimentation.

In Appalachia, the spread of the sands was not alone shoreward over the low-lying rocks of the Siluric, but the disastrophy must have been the slight movement of a low, inclined plane whose negative motion in the old land was counterbalanced by a positive movement in the region of deeper water, for the earliest Oriskany sands are notably calcareous in the fields which had been occupied by the Helderberg sea, but as notably lime-free over regions of the shoreward transgression. These facts are evident in the Helderberg regions of Maryland, Pennsylvania and eastern New York, close upon the Appalachian heart, and confirmed by the sands of the extra-Appalachian regions of western-central New York, Ontario and Illinois.

We may have been disposed to believe that the typical fauna of these early sands in America, which in this place we may characterize as Oriskany, an assemblage made distinctive by its heavy shelled brachiopods, *Rensselaeria* (*ovoides* group), *Hipparionyx, Leptaenaventricosa, Spirifer* (*arenosus* type) and species of the *Spirifer murchisoni* group, large *Leptostrophias, Plethorhynchus, Leptocoelia flabellites,* etc., gastropods of large size (*Diaphorostoma ventricosa* and many capulids); these and their less conspicuous associates were normal to these shallow waters; but there is good evidence that the fauna of the sands and their shallow waters were actually adjusted by slow adaption from the deeper waters of the lime bottoms. This proposition would always be reasonable under general conditions — the creeping of a deeper water fauna shorewards; it is specifically indicated by the conditions in the northeastern Appalachians of Gaspé. One must bear in mind that in respect to tectonic age these northeastern Devonic mountains are the earliest of the entire chain; the Appalachian folding was begun here and proceeded thence southward. In direct semblance to the relative age of these Gaspé folds are the heavy limestone beds of the Grande Grève formation in whose profuse fauna are the

species above listed, abounding in full address, companioned by an entourage which, in part, elsewhere accompanies the Oriskany, but also in part showing forth the Helderberg fauna in the dress of later evolution. Here, I take it (and have endeavored to give the demonstration in full) in these lime seas this northern Oriskany or sandstone fauna of Appalachia took its origin and thence it traveled southward through the open rias of that ancient coast into the seas within the Appalachian barriers. Here, then, was a wide open channel inward, in the northernmost of these Appalachian passages, and with the inward movement of the fauna came its differentiation and slow adjustment to the shoal waters.

In obvious contrast to this southwestern movement of the true Appalachian Oriskany faunas was the migration through the parallel channels of this northeast region lying farther to the south, one where now the Bay Chaleur indents the Gaspé coast and perhaps along others which lay between this and that equally ancient passage, the Bay of Fundy.

These are indicated by the wholly arenaceous early Devonic beds stretching across the state of Maine from Aroostook county on the east through Piscataquis and Penobscot counties to Somerset on the west. In all these shallow water channels there is a persistent and well-defined element of the Coblentzian faunas which enforces the contrast between them and the normal or standard Oriskany of New York.

The case of the Gaspé sandstone. The Gaspé sandstone is a unit of still somewhat uncertain limitations in stratigraphy, though its base is definitely understood and lies at a small unconformity with the Lower Devonic limestones. This evidence is taken wholly from the thinned northern edges of the sandstone mantle on Gaspé bay. Southward the horizontal development of the sandstones is apparently and perhaps, in places, obviously continuous in their upper part with the lower masses of sand and conglomerate which enter into the composition of the formation on the Gaspé peninsula known as the " Bonaventure," a term which appears to be correctly interpreted as Devono-Carbonic, in the sense that it embraces locally and throughout the region of its typical developments from Bonaventure island southward, a series of essentially continental deposits unconformably succeeding the marine Middle Devonic. The Gaspé sandstones of Gaspé bay contain a marine fauna which carries certain Oriskany species, *Rensselaeria ovoides* (*gaspensis*), *Eatonia peculiaris,* survivors of the Grande Grève fauna beneath, but the majority of species in the assemblage, the pelecypods and

gastropods particularly, have specific resemblances and indentities with the described species of the Hamilton (Middle Devonic) sand-shales of New York. I have so interpreted them. The suggestion, however, has been made by Professor Williams that the species of pelecypods find striking semblances among the species of the Coblentzian. We may be sure this is so, for there are similitudes running throughout the pelecypod faunas of the Devonic which are actually a hindrance rather than a help to the determination of specific values. I think, however, that the careful consideration of the Gaspé sandstone marine species can leave no doubt of their later than Oriskany age, even without the evidence from the stratigraphy. Then, further, as long ago shown by Logan and in detail by Dawson, these sandstones on Gaspé bay carry a profuse terrestrial flora of unquestionable Middle Devonic age. We have then here in the Gaspé bay region the singular phenomenon of a highly calcareous "Oriskany" whose lower beds carry the typical species of that fauna and in whose higher limestones there are still commanding representations of the fauna with additions of a later (Onondaga) type, followed above by heavy sands wherein are still surviving species of the Oriskany, themselves autocthonic, but enmeshed in an assemblage of post-Oriskany and post-Onondaga age. The fact is that with the introduction of the Gaspé sandstone begins the deposition of a widespread delta on whose outer fringe only, here and there, has a rather depauperated marine fauna been able to subsist, while the shoreward beds received the outwash of the land with its debris from the Devonic jungles. The evident adjustment of the "Oriskany" species to a gravelly bottom and in their proper place in the succession, is shown, for Gaspé, in a single known band in the Percé cliffs.

The extraordinary concurrence of the primitive Appalachian topography of the Maritime Provinces with that of today. The bays and endroits of the present Gaspé coast, like the bays and shores of Nova Scotia and Cape Breton, are the synclines and flanks of the Appalachian folds. Overridden in part by horizontal deposits in the late Devonic, the Carbonic and Permic of post-Appalachia, they have come again above the waterline by elevation and erosion and now conform the coast line and the continent to their ancient curves. The apparent return after the ages to the forms of so distant a past is in northern Gaspé not that, but the simple retention of the original form. Gaspé bay lies in a syncline as old as the Appalachian system and, in less degree, so do the

larger rivers and their barachois. There is probably no other region where so ancient a topography is still in so obvious control.

The southward spread of the sand transgression. Of the lime seas of the opening Devonic in regions which bounded the broken Siluric lands of northern South America, we have no knowledge. The basin of the Amazonas is sheeted with Devonic sands that lie close upon the Siluric limestones. The sand deposits of the Rios Maecurú, Ereré and Curuá are not far away from the Siluric limestones of the Rio Tapajos, and nowhere do we know aught of the lime sediments which represented the deeper deposits of these marine waters. They are absent or lie buried; probably the latter, for the sands are without evidence of continental character. The Maecurú sandstones are sufficiently abundant in species to indicate their part in the great sand transgression of the opening Devonic, but the specific characters of this fauna are not such as to knit them closely with Oriskany faunas of the northern continent. There are the differences which have resulted from distance, from dividing land and submarine barriers, from isolated evolution in embayments or basin seas; there are still the occasional indentities of species, more often of distinctive genera, and, all told, in the Maecurú sandstone an evident relationship in kind and time to the Oriskany-Onondaga of the north. To the German geologist, schooled in the Devonic of his own country, they are "Coblentzian" and have been so termed, with reason, by Doctor Katzer; but they are not adequately characterized by such a term; even less so than by the terms of the North American succession.

From this Amazonas basin northward, Professor Schuchert would disperse the fauna into North America by way of the Gulf of Mexico embayment to connect with the Camden chert Oriskany of Georgia. My own impression is that both the Maecurú and the Camden "Oriskany" sediments represent, by their faunas, embayments from a continental strand line which had connection with the north by way of the Appalachian channel seas, or perhaps, with even more probability, with an outer shelf strand now submerged with so much of the eastern-shore Appalachia.

We have recent knowledge of an extension westward of the "normal" Oriskany fauna of New York into a pure white limestone in St Genevieve county, Missouri, beneath it lying a well-defined Helderberg fauna. This discovery carries the distribution of the Oriskany farther in this direction than was before known. Thence to the Camden cherts of Georgia is a distance so short as to make, to express it in terms of paleogeography, but a narrow

barrier between these deposits. But the faunas in these two approximate points are still so unlike that to infer a junction of the waters across the isthmus is not yet justified. Should it so turn out that the Oriskany strand was here unbroken, we should then have the fauna completing an entire circuit in Appalachia. The St Genevieve basin at the west seems to present the duplication of the conditions in the northeastern lime basins of Gaspé, an essential exclusion of the sand from the contemporaneous deeper water. But we know too little yet of this Missouri basin to institute any satisfactory comparison between its Devonic elements and those of the northeast.

To return then to the Brazilian fauna of the Maecurú river sandstones, we may feel reasonably secure that its distance from the overspread of the northern sands, the opportunities for variations from those faunas by development under conditions of isolation, are the responsible factors for actual and apparent differences in these faunas from those of the north.

It will not do, however, to intensify these differences by statement. The affinities are obvious and they are distinctive in generic characters. In a certain sense there is in comparison with the northern Oriskany, a later tinge to the fauna; species which carry suggestions of the stage next succeeding in the New York succession. This is entirely in accordance with such expectations as we should derive from our knowledge of the Brazilian sections, for the next term above the Maecurú is the sandstone of the Rio Erèré, and its fossils, as described by their discoverers, Hartt and Rathbun, and confirmed by the evidence brought out by Derby and myself, indicate their Middle Devonic age and their rather intimate relations with the Hamilton of New York. The intermediate limestone term of the series present in the New York succession is then missing here, with our present knowledge, but the open and freer connection of this later shallow sea with the northern seas of the Middle Devonic is a very pronounced fact. In speaking of the Gaspé sandstone fauna, I have referred to Professor Williams's intimation that its pelecypods might be construed as Lower Devonic (Oriskany-Coblentzian), and I may here refer to Doctor Katzer's contention that the Erèré sandstone fauna is likewise Lower Devonic. The two suggestions are not alike in quality nor based on like argumentation, though similar in purport. Yet with close analysis of these faunas we are not prepared to concede these alternative propositions, even though at the south, the later Erèré sandstone is in direct continuity with the earlier or Maecurú. At all events, the specific and generic similitudes of these two Amazon faunas with those at

the north, greater in the later (Erèré) stage than in the earlier (Maecurú), cease and determine at these latitudes.

The austral faunas of Brazil, Argentina and the Falkland islands. The employment of the term *austral,* which I have used before as an emphatic distinction from the boreal faunas, means that in these regions under consideration and in Cape Colony as well, in other words, throughout the higher latitudes of both southern continents, there is a palpable and fundamental difference from the boreal faunas. The fact may well be stated with emphasis, but not to the exclusion of certain common bonds which declare the age of the faunas. It is well known now, was stated by Steinmann, A. Ulrich and Knod for Bolivia and corroborated by my own somewhat protracted researches upon materials from São Paulo, the Argentinian Cordilleras and the Falkland islands, that, in terms of biology, there is no Devonic in these southern latitudes except the early Devonic. Whatever the thickness of the sedimentation may be (unknown now) and whatever its lithology, it is all of an age which corresponds in paleontology to the early Devonic of the north. Whether the duration of deposition here does or does not represent only that of the northern Lower Devonic or that of the entire northern Devonic, it is perfectly clear that the fauna is one fauna and endured from the beginning to end of marine Devonic deposition. If there may have been a series of later Devonic faunas in these regions, we must say either that they were cut out by geography or cover our ignorance in the buried rocks. Professor Kayser, writing on some of the spirifers from Tibagy, in São Paulo, was among the first to indicate the quality of the Brazilian fauna, and the work of A. Ulrich and Knod in Bolivia has added confirmation to the interpretation of this Devonic.

Now that we have assembled the fauna of all these regions in reasonable fulness, the conclusion regarding the time equivalence of the entire austral fauna stands out with clarity. The Falkland sandstones, the Tibagy sands, the São Paulo lime muds, the sands of Argentina are variations in sedimentation whose exact relations in stratigraphy are not yet known, but which are knit together by a common biology. An obstacle to the solution of the real character of the paleontology here has been the natural impulse on the part of students in this field, bringing to their interpretations an acquaintance with the boreal Devonic, to enforce parallels and identifications of southern with northern species — to squeeze the unknown into the moulds of the known — a customary and often an almost imperative procedure.

The composition of this austral Devonic fauna, on close analysis, brings out the evident fact that, whatever its origin, it has developed its peculiar characteristics under the influence of isolation from the other Devonic basins and shelf-seas of this stage. In South Africa it may be demonstrable on further evidence that the same fauna was preceded by a period of continental deposition properly included within the Devonic system. But in either case there is no indication that the primary calcareous term of the northern Devonic, by its absence in the south, is to be regarded as a factor of any weight whatsoever in estimating the relative stage of the austral fauna. In the Falkland islands, where the affiliations of the marine fauna are more intimate with that of the Bokkeveld beds than with the nearer South America fauna, there fails as yet any evidence of a preliminary Devonic deposit of continental character.

These extensive and reasonably profuse faunas of the southern Devonic strands developed along a continent obviously separated from that at the north, and for most of its extent widely by equatorial Atlantic waters, but narrowly in the subequatorial latitudes of Brazil, where the Amazonas faunas, with affiliations toward the north, lie not far away from the Devonic beds of Matto Grosso with evident alliances with the south. The marine Devonic was the strand of a Pre-Gondwana land of whose constituent sedimentary rocks we know little save for the occasional dredging of altered sediments from the Atlantic bottom, the gneissoid inclusions in the deep-seated lavas of the mid-Atlantic islands, and perhaps some part of the crystallines of the southern islands, South Georgia, the South Shetlands and of Antarctica. To these are to be added the South African premarine Devonic series capped by the Table Mountain sandstone, now regarded by some writers as of glacial origin, and, of course, some part of the Precambric crystallines of South America and Africa.

Our present knowledge leads us to the conception of an Andean Siluric and Cambric land reaching far to the north along the Cordilleran rib, for the limestones of eastern Argentina, Bolivia and Peru carrying *Liorhynchus bodenbenderi* and its associated fossils, are Siluric, not Devonic. The stretch of the Devonic strand along the Cordilleran rib far to the north is now well known and there is every reason to believe that the Pre-Gondwana land which traversed the south Atlantic extended an arm well to the north on the Pacific side. Pre-Gondwana land was thus a very ancient austral continent, and wholly comparable in extent and age to Laurentia at the north. The latter, in days before the Caledonian folding, traversed

the north Atlantic basin, just as the former, perhaps more insulated but of wider extent, stretched across the south Atlantic from southwest northeasterly.

Problem of the black shales. The Upper Devonic of Appalachia is eminently characterized by its abundance, often preponderance, of black shale beds. These are thickest in Michigan, Ohio, Tennessee and Kentucky and seem to thin continuously eastward into New York. Not all students have agreed in construing the entire heavy mass of these bituminous shales as Devonic, but the upper divisions (Chattanooga shales) have been, with some reason, assigned to the opening stage of the Carbonic. It is probably true that these shale bands have been studied most closely in New York where it is evident that they represent the thinning edge of the body of this sediment. Here the upper black shales of the Genesee and Portage groups have caught more abundantly than elsewhere the characteristic marine fauna of the intercalated deep water marine. A customary interpretation of the origin of these black Devonic shales was that of shallow water origin. This conception assumed, largely on the basis of the plant remains in which the rocks abound and especially the accumulations of sporiferous deposits occurring in the Ohio beds, that they were near-shore beds formed in shallow basins with choked outlets. Another popular explanation was to refer them to the accumulation of fat muds beneath a Sargasso sea. Both interpretations, twenty years ago, were accepted alternatively without special scrutiny. At a later date the writer had occasion to give attention to the problem and in seeking a solution brought out the very evident fact that the known seaward sweep of terrestrial vegetation by rivers of the land into the rivers of the ocean, the abundance of such distant flotsam observed by oceanographers, failed to compel any such interpretation as the first, while the Sargasso sea conception is entirely eliminated by the nature of the flora of these shales, which is wholly terrestrial. The Genesee and Portage black shales, furthermore, were shown to carry a highly characteristic marine fauna, whose elements show a deep water habitus.

These older conceptions have the merit of the obvious and specious. There are, however, deeper considerations which have been brought out with some degree of analytical force and which are not in harmony with this interpretation of a shallow water origin for these extensive deposits. If I am not mistaken, it was Professor Williams who first directed attention to the fact that in all the bituminous shale beds of the Appalachian Paleozoic succes-

sion — the Utica shale of the Ordovicic, the Marcellus of the Middle Devonic, and these Genesee-Portage shales of the Upper Devonic — there is throughout a common character in the aspect of the contained marine fauna. Deficiency of lime makes all species thin shelled; all species are of rather depauperated size, phosphatic brachiopods (*Lingula, Orbiculoidea* etc.) abound while the lime-shelled species are few, small cephalopods are frequent while other Mollusca are rarer and fragile. The statement is only a natural expression of the effect of like conditions on various faunas.

1 The faunas of the Genesee-Portage are strictly marine;

2 They are, taken as a whole, of the deep water type which emphasizes the Portage fauna in its highest development (Intumescens fauna); indeed, they represent this fauna;

3 The shales carry a thin lime deposit, continuous over a great extent of latitude and essentially a mass of pteropods. I have indicated that this Styliolina or Genundewa limestone holds the pteropod Styliolina in numbers of 50,000 — 100,000 to the cubic inch. By analogy these minute creatures are pelagic open sea animals. These limestones, too, carry the Intumescens fauna in a typical though prenuncial development;

4 The shales abound in exudations of FeS_2; indeed, the base of the Genesee shale in western New York rests on a continuous layer of pyrite extending for 100 miles and carrying the relicts of a fauna (Hamilton) dismally dwarfed by the foul conditions which it hopelessly tried to survive.

These features of the fauna and their physical surroundings I have found illuminated by the parallel conditions prevailing in the depths of great inclosed seas like the Mediterranean and the Black Sea, where limeless waters, free liberation of sulphur in connection with a rapid organic decomposition under great pressure, are producing such foul bottoms with sulphide compounds, dwarfed and thin-shelled Mollusca, always, of course, with the accretion of what may fall in from flotage and dying pelagic life. These inferences as to the deep water origin of the black shales are corroborated by their greater thickness westward of New York.

In extraordinary contrast to these conclusions is the proposition put forward by Professor Grabau that the bituminous shales are delta deposits, brought in by a putative southwestern river flowing northeasterly, discharging this singular supposed fluviatile-continental mass over an area of many hundreds of square miles. This view seems to the writer the extreme expression of a recent obvious tendency to magnify the part contributed by alluvial floors and fans, desert desiccation and other continental factors to the upbuilding of the geological column.

The Old Red Sandstone. The conception of these beds as to origin is now rather definitely formulated. Through years of wavering interpretation we have reached a point at which we may concede the essential continental origin of most of the deposits which may be fairly embraced under the designation above employed. The force and proof of this conception is largely due to the effective work of Professor Barrell, who has attacked the problem from an angle new to the usual approach. The Catskill formation of the Appalachians and the Oneonta sandstone which lies at or is continuous with its western base, are, according to this interpretation, the outwash or delta plains composed of the debris of the more easterly lying mountainous lands, now either completely lost beneath the eastern sea or represented only by their metamorphosed roots.

I think that for the interpretation of these great delta plains fringing the interior sea of the Upper Devonic, too little emphasis has been laid on the tremendous mid-Devonic mountain making all through the northern Caledonid Appalachians — a time of orogenic revolution which greately overpassed in energy that of any other period in the history of the mountains. With the opening of late Devonic time, all through this region there were the newly made mountains rising to fresh heights and inviting the most vigorous attack of meteoric waters; inviting, too, as a natural consequence, the formation of such tremendous plains of continental debris all along the shore lines.

There must have been on the now buried eastern shores of Appalachia, deltas of similar origin and extent to those we now know on the western shores. While the general proposition is a closed one and we may find satisfying explanations of all the phenomena presented by the accumulation of continental material on the edges of a marine basin, with all necessary accompanying phenomena of interdigitation of deposits, local repulse and invasion of marine faunas, etc., there still remain some open questions as to the scope of the continental factor, in time, and as to its exclusiveness in effect.

Does the Catskill formation, in its typical development in the Catskill mountains of New York, represent exclusively Devonic sedimentation, or does it transcend the Devonic boundary? Assumption commonly favors the former, but there are outside evidences that indicate the latter presumption, drawn from a consideration of the Bonaventure conglomerate.

Bonaventure conglomerate. This mantle of sandstone and conglomerate sheets the present coasts of the northern Maritime Provinces of Appalachia, seldom extending inland in its region

of typical development. It was commonly regarded by earlier observers as lying unconformably on the Gaspé sandstones and by Logan, who first described and named it, as a Carbonic formation. I have made reference already in speaking of the Gaspé sandstone, to the presumable horizontal continuity of the two, the upper beds of the former with the lower beds of the latter, intimating thereby no interruption of deposition though with an evident change of coast line and drainage.

In fact, in this respect, in the northernmost extent of the Bonaventure formation and the southernmost of the Gaspé sandstone, the relations presented are similar to those of the early Catskill stage and the marine Devonic (Ithaca) of the westward seas. In southern Gaspé and thence into the lower gulf, the Bonaventure lies everywhere atop of the almost vertical Siluric-Ordovicic limestones and, in places, on the equally upturned Lower Devonic. So here again in this Bonaventure formation is the evidence of great land waste from the folded early Devonic mountains, obviously from a land eastward of the present coast. The conglomerates of the Bonaventure carry fossiliferous pebbles and boulders of all the earlier formations, those of the Lower Devonic being of greatest abundance, but with exception of these last the boulders are largely from beds unfamiliar to the present land. I am not yet satisfied that any of these boulders which have come under my observation are ice-scratched, but many of them are very large and occasionally one will weigh several hundred pounds. Indeed, Sir William Logan records one of them which weighed a ton. We are not justified yet in appealing to the action of any other agencies in accumulating these, except continental water and shore ice with the addition of the work that would be done along the higher coasts of the mountains, on its headlands and promontories by the pounding of the sea. To the latter I believe we must ascribe a definite part in the work of building the formation.

The evidence that the Bonaventure transcends Devonic time is largely negative; it lies on no fossil evidence, though plant remains of still undetermined character are scattered through the sand beds. But in this region it represents all the rest of Paleozoic time that is recorded by the rocks, and what part of the piie may be Carbonic must be determined from the study of the still little known accumulation of this continental waste which sheets New Brunswick.

At Migouasha or Scaumenac bay at the head of the Bay Chaleur, there is a different expression presented in the gray and more cal-

careous sand cliffs carrying the extraordinary profusion of Ostracoderm and Crossopterygian fishes and beautifully preserved ferns. The plants are natural land wash while the fishes are presumably the natives of the stream mouths, probably migrant into the fresh waters for spawning purposes, like the salmon which today maintain this historic procedure in the streams which traverse these rocks. Beneath these remarkable cliffs is a gray boulder shale whose boulders are more largely of the fossiliferous limestones and less of the crystallines than in the Bonaventure. We are not yet prepared to be positive regarding the origin of this underlying boulder shale. Its matrix resolves easily to clay and squeezes out over the landwash, setting its boulders free. Its component blocks are fractured, impressed and ice-scratched. The students of the fish-bearing *Magouasha beds* above are quite in accord in regarding them as of Upper Devonic age, though this conclusion has not as yet full confirmation from the other biotic elements.

The late Doctor Ells found evidence satisfactory to him of an unconformity within the mass of the Bonaventure conglomerate which was assumed to divide the time of its deposition by a slight diastrophy. If this interesting division can be fully demonstrated, it establishes a very noteworthy agreement with the Old Red of northern Scotland which is marked by a widespread disconformity of this kind.

Origin of the Intumescens-fauna. It was essentially with the help of Professor Kayser's studies of the " Intumescens fauna " of the Upper Devonic, that the writer prosecuted his investigations of this fauna in America. The " Intumescens-fauna " of the Genesee-Portage stage has proved to have had a profuse and highly characteristic development in western New York, though quite suddenly losing itself thence in all directions. Eastward its place is taken in contemporaneous strata by the brachiopod faunas of the Ithaca and Chemung groups, so that no evidence of its existence is to be found on the western shores of old Appalachia. Westward traces of it are found here and there, in Iowa, in Manitoba, a striking development in Montana. The fauna, it was claimed by the writer, took its origin from the region of its great development in northern Siberia (Timan), and its dispersal was eastward along American strands into the interior sea of early Upper Devonic Appalachia where, favored by its isolation, it burst out into a fulness of development. Professor Schuchert, in the construction of his paleogeographic maps, has felt it necessary to introduce this fauna from

the east through a putative passageway across Appalachia, in northern New Jersey. Paleogeography makes many tentative demands of its followers. The writer could never visualize this gateway and Professor Barrell, after long study, has hung over it the sign: "Closed."

The extent of Devonic intra-Appalachian vulcanism. Outside the western hemisphere, volcanic activity was widespread during the early Devonic. The interior Devonic basin of North America has been regarded as almost devoid of such activities and, from South America, we have no present knowledge of volcanic outflows in the sheet of Devonic sediments. The contrast in this regard between the basins or intermontane channels of the northeast Appalachians and those farther south is very marked. Rhyolitic ashes and scoriae interlaminate the marine Lower Devonic of Dalhousie; volcanic dikes traverse the lower limestones on the Grande Grève peninsula; the Gaspé sandstone is cut in several places by such dikes and the Bonaventure formation is locally overwhelmed by lava outpours. New York and the interior region are not wholly without such evidences — dikes of alnoite penetrate the Upper Devonic near Ithaca, serpentinized peridotite forms dikes which traverse the Siluric and Devonic about Syracuse; dikes of like character, in an extensive parallel series, cut the Ordovicic of the Mohawk valley and may have penetrated, in all probability did, a once overlying Devonic mantle. These dike intrusions, however, are along preexistent fault or joint lines, all accessory to the orogenic structure of the eastern mountains. In other forms than this, vulcanism, it has been generally regarded, does not manifest itself in these Devonic areas of the interior.

Over the St Lawrence lowlands lying between Montreal and the New York-Vermont boundary, is an array of volcanic stacks and domes varying in size and effect from the most majestic in Mount Royal, to the lesser ones at the south; all of which have been termed by Doctor Adams, the "Monteregian Hills." These are lavas in various stages of differentiation but all have obviously penetrated a great plain of Ordovicic (Lorraine) shales. There is, however, a definite indication of the age of these intrusions presented by the contact breccias known on St Helen island near Mount Royal, in which are fragments bearing unquestionable Lower Devonic fossils; fixing thus the age of the lava intrusions as at least post-Lower Devonic. These blocks in the breccia are the only known trace of the Devonic in all this region, from the St Lawrence southward into

the mountain folds of New Hampshire, and the inevitable conclusion is before us of their former existence here and present almost total destruction.

Quite outside of this Monteregian province ("a petrographic province," Adams), about 150 miles to the south within the State of New York, lies the volcanic plug known, from its historic associations, as "Stark's Redoubt." This volcanic mass, very limited in width and extent, has been the subject of much study and discussion. Apparently it is a basic pillow lava, deeply serpentinized and having the aspect of a kimberlite with a surprising amount of free carbon. It seems to be interbedded with "Hudson River" shales which at this point are of Ordovicic age, but the mass is sheared and the shales faulted against it and there is little doubt that the lava transected the lower part of the shale beds. In our present knowledge of the former extent of the Devonic rocks, in New York at least, beyond their actual outcrops; our necessary admission of their removal over tremendous areas by ice erosion; in view of such evidence of great loss as is brought out by the arctic distribution of these rocks (see next caption), and, for specific example, by the great upstanding edge of the Helderberg escarpment in New York whose abruptly cut-off edges face the great north where once its undiminished sheets of strata must have extended but where today no trace of Devonic has survived; such evidence approves the conception that the "Stark's Redoubt" volcano, like the Monteregian Hills, is of like origin and date — not earlier than Lower Devonic, and like them a manifestation of the igneous intrusions and outpours which characterized the Caledonid type of Devonic orogeny.

A world of knowledge regarding the distribution of Devonic seas and faunas awaits us from both Arctic and Antarctic America. No fields, perhaps, are left where so important clues are buried and though these lie under a grievous load, they nevertheless beckon most alluringly to the hardy spirit. The suggestive geologic data brought away from Antarctica first by Eights of Albany and more than three-quarters of a century later by Shackelton and the lamented Scott forecast the light from these Cimmerian latitudes. The remarkable collections gathered from Arctic Ellesmere-land by Doctor Schei of the second "Fram" expedition, intimated an extraordinary development of Appalachin Devonic in the high north

Meyer, Loewe and Holtedahl, who have worked out the paleontologic factors of this Devonic succession, have demonstrated a highly developed series beginning with an actual representation of the calcareous members, the Keyser (or introductory unit of the Maryland succession), the Coeymans and New Scotland members of the Helderberg, and so on upward with a final Devonic member carrying terrestrial plants in a continental sediment.

These important discoveries compel us once more to reconstruct the paleogeographic map, for the most obvious conclusion derived from these data is the direct and immediate connection of fairly deep arctic marine waters with the interior seas of Appalachia. The Siluric bay, which has been made to reach its long way southward from the Arctic into the interior and has been conceived to have brought thence its faunas, reached up rather than down, and its waters were not shrunken at the close of the Siluric by a northern positive movement of the land. Palpably, as Doctor Meyer has suggested, the Devonic water way to the north must have been wide open all about these western and northwestern shores of the great Laurentia; and if the Devonic strata fail to appear there in the interval between New York, southern Ontario and Ellesmere-land, it is either because their remains still lie unrevealed or have been swept away by heavy erosion.

NOTES ON THE INTRAFORMATIONAL CONTORTED STRATA AT TRENTON FALLS

BY WILLIAM J. MILLER

INTRODUCTION

In 1908 the writer published a short paper in the Journal of Geology [1] describing the contorted strata within the Trenton formation at Trenton Falls in central New York and offering an explanation of the phenomena.

Recently (1913) there has appeared an elaborate paper by the late F. F. Hahn in the Neues Jahrbuch für Mineralogie, Geologie und Paleontologie [2] in which the contorted strata at Trenton Falls are particularly discussed and an entirely different explanation is offered for the phenomena there, as well as for apparently similar phenomena in certain other parts of the world.

Grabau [3] (1913) discusses the contorted zones at Trenton Falls and similar phenomena elsewhere and fully accepts Hahn's explanation, but he neither states nor presents arguments against the present writer's hypothesis.

It is not the present purpose to consider intraformational corrugations in general, but rather to confine attention to such features as are to be observed at Trenton Falls. It will be shown that Hahn's explanation can not apply there. It is generally agreed that intraformational contortions may be produced in several ways, and the present concern is to find the correct explanation of the cause of the particular phenomena at Trenton Falls. For certain details not repeated in this paper, the reader should consult the two papers above cited.

THE CONTORTED ZONES WITHIN THE TRENTON FORMATION

Excellent examples of highly folded or contorted strata between nonfolded strata may be seen along the sides of the gorge at Trenton Falls where the disturbed beds occur at two very distinct

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[1] Highly Folded Between Non-folded Strata at Trenton Falls, N. Y. Jour. Geol., 16: 428–33.

[2] Untermeerische Gleitung bei Trenton Falls (Nordamerika) und ihr Verhältnis zu ähnlichen Störungsbildern: Neues Jahrbuch. 36: 1–41, 1913.

[3] Principles of Stratigraphy, p. 783–84.

horizons within the Trenton limestone. The lower contorted zone, whose base lies 144 feet below the top of the Trenton, is from 4 to 6 feet thick. It is visible only near the crest of the lower part of the High fall (see accompanying plate) and in the upper end of the gorge near Prospect village where the strata are highly inclined. The upper contorted zone, whose base lies 65 or 70 feet below the top of the Trenton, is from about 5 to 12 or 15 feet thick. It is well exhibited along the path opposite High fall from which point it may be traced along the sides of the gorge for nearly 2 miles to Prospect.[1]

The impure limestone layers of both the folded and nonfolded portions average only a few inches in thickness and are separated by thin bands of shale. Within the folded zone horizons the layers are, in some cases, scarcely folded or broken; sometimes they are gently folded or tilted; while most commonly they are highly folded and fractured (figure 1).

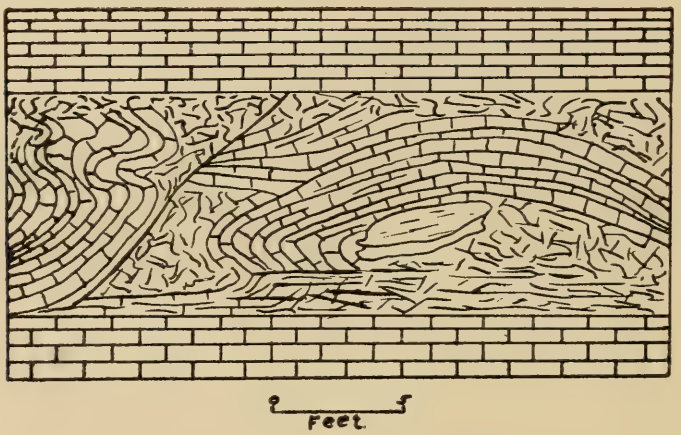
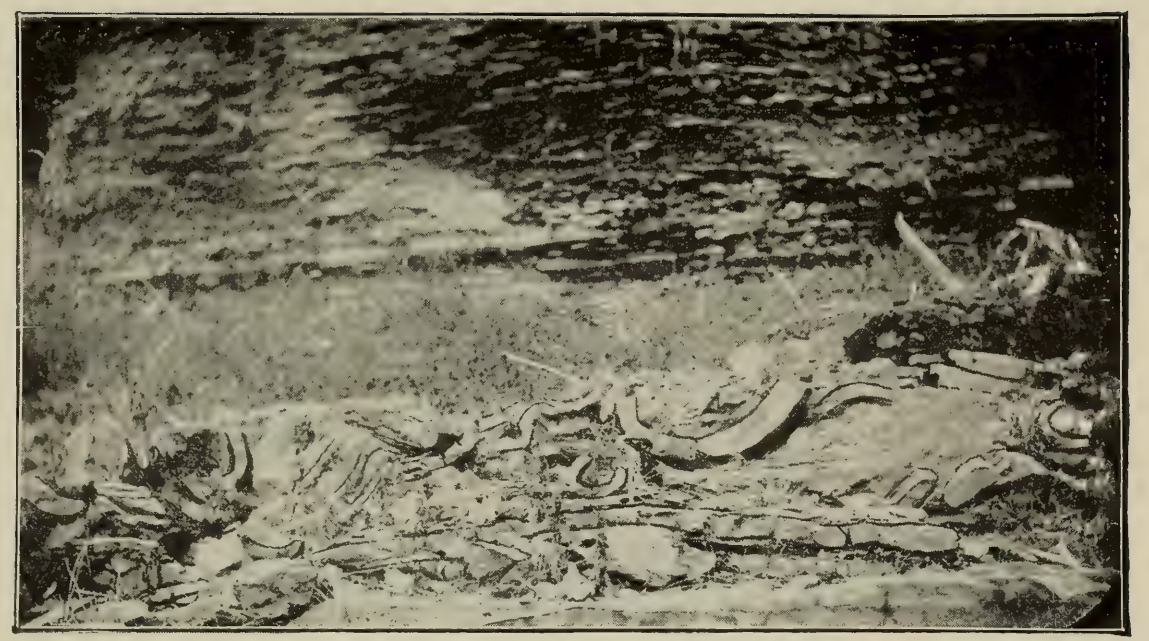


Fig. 1. The upper contorted and broken zone as seen along the footpath opposite the crest of High fall at Trenton Falls. Drawn from nature.

Numerous observations show the strikes of the contorted zone folds to be from N. 50° E. to N. 65° E. or practically parallel to the strike of the distinct folds in the Trenton formation in this region, as well as parallel to the strike of the well-defined fault-fold line passing through the village of Prospect (see geologic map).

It should also be noted that these contorted strata occur only in a very local district. As far as they can be ascertained they are

[1] The interested reader should consult the writer's geologic map of the Remsen quadrangle in N. Y. State Mus. Bul. 126.



T. G. White, photo.

The lower contorted and broken zone as seen near the crest of the lower part of High fall, at Trenton Falls

visible only in the Trenton Falls gorge and in the bed of Cincinnati creek 1½ miles southwest of Prospect.

HYPOTHESES REGARDING THE CAUSE OF THE CONTORTIONS

Tectonic hypothesis. The explanation offered by the writer is that the contorted zones were produced by differential movements within the mass of the Trenton limestone. The displacement (140 feet) of the thrust fault at Prospect village was sufficient to cause the beds of the middle Trenton to slide over beds of the upper Trenton. Near the fault-surface the strata on the upthrow side are bent upward at angles of from 30 to 40 degrees. Figure 2 shows the relation of the folded zones to this fault.

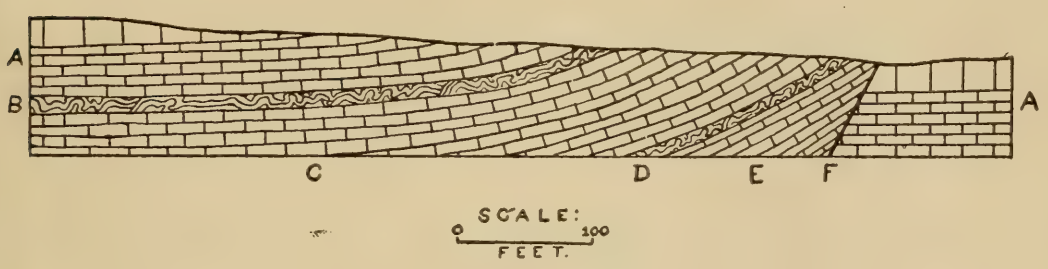


Fig. 2. Section showing the position of the two corrugated zones within the Trenton formation and their relation to the thrust fault at Prospect, near Trenton Falls

It is easy to see how, when the force of compression was brought to bear in the region, the higher Trenton beds on the upthrow side must have moved more easily and consequently faster than the lower Trenton beds. For instance, the portion A in figures 1 and 2 being separated from C by an intermediate mass B of possibly slightly less rigidity would slide over C and cause the portion B to become ruffled or folded and fractured. Occasionally parts of zone B would be moved very little or would be moved along without being folded. The portion B would need to be only very slightly less rigid than the adjacent portions. The somewhat thinner limestone layers separated by thicker shale partings would cause the part B to be thus less rigid. A similar explanation applies to the lower folded zone, and the folded or contorted zones thus merely indicate horizons along which the differential movements have taken place.

Some of the points favoring this tectonic hypothesis are as follows:

1 The very existence of the thrust fault at Prospect and the distinct folds in the Trenton formation just to the south make it certain that there must have been differential movements within the mass of the formation.

2 Contorted zones are known to have been produced by differential movement of more resistant beds over weaker beds in various regions of folded rocks (for example, Marquette district of Michigan).

3 The parallelism of the strike of the folds of the Trenton formation with that of the fault at Prospect.

4 The parallelism of the strikes of the small folds and faults of the contorted zones with the strikes of the larger folds and the fault at Prospect.

5 The limitation of the contorted zones to the upthrow side of the only considerable thrust fault in the Paleozoic rocks of central New York.

6 The absolute limitation of the contorted zones to two very definite horizons in the Trenton formation instead of there being masses of disturbed strata irregularly distributed through the formation.

7 The worn character of the upper and lower surfaces of the contorted zones marked by layers of limestone sharply broken across and the presence of numerous fragments of limestone.

8 The corrugations could not have been produced before deposition of the overlying masses because (*a*) the limestone layers at least were comparatively hard and brittle when contorted, as shown by the numerous sharp breaks; (*b*) there is no evidence of very irregular or crumpled upper surfaces of the contorted zones with sediment deposited in the irregularities or depressions; and (*c*) any attempt to explain the contortions as due to slumping of masses on the sea bottom is utterly opposed by the low angle and direction of slope of the sea bottom as brought out below, and the remarkable thinness and considerable extent (2 miles) of the contorted zones.

9 Experimental evidence clearly suggests the possibility of production of contorted zones by such differential movements.

Hypothesis of submarine gliding. According to Hahn, the contorted zones at Trenton Falls are excellent examples of phenomena which have been produced by sliding or slumping of masses on a sloping sea bottom during the process of sedimentation. The accompanying diagram (figure 3) will serve to illustrate the principle.

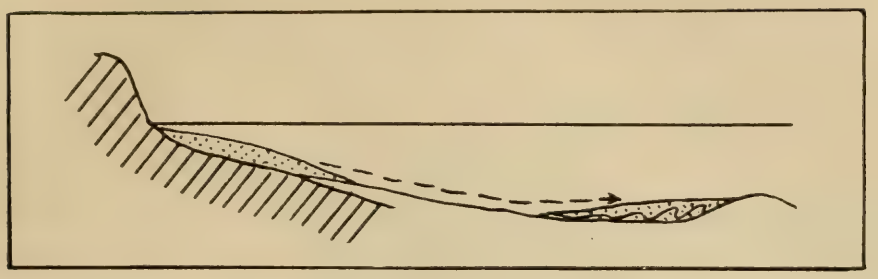


Fig. 3. Diagram illustrating Hahn's hypothesis of submarine slumping

A lenslike mass breaking loose from any cause (for example, earthquake shock) would glide down the submarine slope and, because of increased friction and water pressure and the striking of some obstacle on the sea bottom, the gliding mass would come to rest only after it had become considerably deformed or contorted, as shown in the diagram. Sediments would then be deposited in normal order over the crumpled layer. The most intense folding would be toward the front of the transposed mass and of course the strike of the folds would be at right angles to the direction of movement of the sliding mass. Conditions for such submarine gliding are regarded as favorable at many places along the marginal sea bottom.

Some of the points supporting this submarine sliding hypothesis, according to Hahn, are as follows:

1 Observed production of contortions by subaqueous gliding, for example, that in Lake Zurich 1875.

2 Various portions of the sea bottom are known to have slopes of from 4 to 18 degrees or more which would be sufficiently steep for masses to slide down under certain conditions.

3 The texture (character) of materials within the contorted zones is essentially the same as that of the underlying and overlying materials, and hence the disturbed zones were not horizons of weakness which were distorted under pressure.

4 The analogy of the Trenton Falls contorted zones with those of certain other regions.

5 Tectonic contortions are pressure phenomena produced under heavy loads.

6 The corrugated zones are not of tectonic origin, that is, due to differential movements within the Trenton limestone because of (*a*) absence of stretched or flattened out masses; (*b*) absence of distinct slickensided or streaked surfaces; and (*c*) absence of fragments of both the underlying and overlying masses within the disturbed zones.

7 No clear drag or gliding zone is visible, but rather there is often gradual transition between the contorted zones and the overlying strata.

DISCUSSION OF THE HYPOTHESES

Certain points not mentioned above as well as others requiring fuller discussion will now be considered. It is not the purpose of this paper to deny that, under proper conditions, subaqueous slumping, with resulting contortions, may take place, but it is our concern to show that the contorted zones at Trenton Falls do not admit of such explanation.

An important fact, which in itself is well-nigh fatal to the hypothesis of submarine slumping, is that the slope of the sea bottom on which deposition of the Trenton beds took place was altogether too slight. The writer has presented detailed evidence to prove that, in the Trenton Falls district, the sea bottom receiving Trenton deposits was remarkably smooth and with greatest slope toward the southwest at the rate of only 6 to 20 feet a mile.[1] Similar evidence for the adjoining Little Falls[2] and Port Leyden[3] districts by Cushing and the writer show respective slopes of only 6 to 10 and about 30 feet a mile. Considering a slope of 12 or 15 feet a mile at Trenton Falls, this is 30 to 40 times less than the slope (4 to 6 degrees) in Lake Zurich, which Hahn cites as a remarkable instance of very slight slope upon which slumping occurred. In fact the floor of the Trenton sea in the vicinity of Trenton Falls was so nearly perfectly horizontal that any such slumping or gliding of masses, as required by Hahn's hypothesis, could not have taken place.

But, even if we grant the possibility of submarine gliding, another difficulty stands in the way, namely, that the gliding masses, as judged by the obvious criterion of strikes of small folds within the contorted zones, must have slumped off toward the northwest when, as a matter of fact, the greatest slope of the sea bottom was at right angles to this, or to the southwest.

Emphasis is placed by Hahn upon the fact that the materials of the contorted zones are not notably different (weaker) than the inclosing materials. While differential motions would certainly tend to concentrate along distinctly weaker belts, such belts are not deemed absolutely essential because the slipping once having even

[1] N. Y. State Mus. Bul. 126, p. 36.
[2] N. Y. State Mus. Bul. 77, p. 61.
[3] N. Y. State Mus. Bul. 135, p. 43.

a little start, as along two horizons within the formation, any renewed or continued movement would tend to follow the same horizons. It is at least significant that the contorted zones occur in the weakest portion of the Trenton formation; that is, where the soft shale partings are the most pronounced.

Replying to the statement that tectonic contortions are pressure phenomena produced under heavy loads, it may be said that, in the light of comparatively recent investigations, a great overlying load would not be necessary in order to permit the development of folded and faulted structures such as those in the contorted zones at Trenton Falls, particularly since the strata are alternating thin layers of unaltered limestone and soft shale. No doubt considerably more overlying rock was present during the folding and faulting process than now. Distinctly stretched or flattened out masses would scarcely have been produced under the pressure conditions which obtained.

In contrasting folds of the zones of fracture and flow, Leith clearly states[1] that there is "little slipping between the beds" in the zone of flow, while there is "much slipping between the beds" in the zone of fracture. The deformation of the strata at Trenton Falls certainly took place in the zone of fracture as proved by the very existence of the sharp thrust fault and the fractured character of the rocks within the contorted zones. Considering also the thick partings of soft shale, it is readily seen that the conditions were very favorable for slipping between the beds or differential movements of the strata.

Hahn also emphasizes the point that slickensides should be very evident according to the tectonic hypothesis. While it is true that some slickensides occur within the disturbed zones, nevertheless they are not very evident at either the tops or bottoms of those zones. When it is remembered that the Trenton consists of alternating soft shales and comparatively hard limestones, it is easy to see how the sliding must have taken place along the bands of soft shale which were more or less crushed but not notably slickensided. In spite of the lack of direct evidence from slickensides, the writer believes that the multitude of sharply broken limestone fragments (apparently not recognized by Hahn) toward the tops and bottoms of the disturbed zones, as well as within them, clearly supports the view that there has been actual rubbing (sliding) of the masses of the disturbed zones against both the overlying and underlying masses. Even if we should grant Hahn's argument concerning lack

[1] Structural Geology, p. 111.

of slickensides, this same argument applies against his own hypothesis, at least as regards the under sides of the disturbed zones. Thus, when the disturbance took place the limestone layers not only were contorted but were hard and brittle enough often to break sharply and rub over each other with occasional evidence of slickensides, and it is quite reasonable to ask why the sliding of large masses of relatively hard rock on the sea bottom took place without leaving distinctly streaked or slickensided gliding surfaces.

The statement that instead of clearly defined drag (or gliding) surfaces there is often gradual transition between the contorted zones and overlying strata may be answered by saying (*a*) that the writer's observations show rather sharp separation between the disturbed strata and overlying undisturbed strata to be quite the rule (see figure 1 and accompanying plate); and (*b*) that the few blocks of apparently undisturbed rock within the horizons of the disturbed zones are blocks which either were moved *en masse* without being crumpled or they are blocks which may have moved relatively little, if any, while the overlying strata slipped along. Blocks of this latter class would have acted as local buttresses against which the deformed layers may have piled up to thicken locally the disturbed zones. Thus, along the footpath just south of the railroad bridge, the strata seem to be in normal order; then passing southward, there are masses of tilted and broken strata forming a zone of unusual thickness (10 to 15 feet); and finally, just opposite the High falls, the highly contorted and broken zone occurs with thickness of 5 to 8 at the same horizon. Such an arrangement of masses within the horizon of a contorted zone is quite in harmony with the idea of northwestward differential movements.

The very local occurrence of the phenomena in proximity to the thrust fault at Prospect and the remarkable coincidence of the strikes of this fault, the distinct folds in the Trenton formation, and the folds and fractures within the contorted zones are facts not to be lightly brushed aside by saying: "Precisely the local occurrence of the phenomenon which Miller emphasizes appears to me to be out of harmony with his explanation. The cited parallelism of the movements is moreover in no sense proof, since to be sure the E. NE-W. SW, or in general E-W, direction already governed the Prepaleozoic Adirondack mass, consequently the later movements followed only an inherited character."[1] The present writer fails to see how either the pressures within or the direction of the Prepaleozoic mass in any way whatever argues against the idea

[1] Hahn: Neues Jahrbuch, 36:8. 1913. Freely translated from the German.

of differential movements within the Trenton formation due to lateral pressure at the time of the thrust faulting.

The submarine gliding hypothesis, as set forth by Hahn, may well enough be the correct explanation of intraformational corrugations in certain regions but, as above shown, there are insuperable difficulties in the way of applying this hypothesis to such phenomena at Trenton Falls. It would seem that Hahn has fallen into a common error of making a single hypothesis or explanation altogether too inclusive in its scope.

THE GREAT RIFT ON CHIMNEY MOUNTAIN

BY WILLIAM J. MILLER

THE MOUNTAIN AND ITS LOCATION

Chimney mountain lies 7 miles south-southeast of Indian Lake village in the Adirondack mountains and in the northwestern portion of the Thirteenth Lake quadrangle of the United States Geological Survey. While making his headquarters at Indian Lake during the summer of 1914, the writer's attention was repeatedly called to a rather remarkable feature toward the top of the mountain and variously ascribed to "some convulsion of nature," "volcanic action," or the "splitting open of the mountain." This paper very briefly gives the results of an examination of the locality, and it is in fact not much more than an explanation of the accompanying plates and figures.

Chimney mountain has two summits about a fourth of a mile apart, the eastern point reaching an altitude of 2705 feet, and the western point about 2640 feet. The Hamilton-Warren county line passes across the mountain between these two summits. Facing the west, the mountain side is very steep with a descent of 900 feet in a half mile.

THE GREAT RIFT

The phenomenon of special interest is a great rift with strike N 20° E directly across the eastern summit of the mountain (see plate 1 and figure 3). Exact figures were not determined, but the rift has an estimated length of 600 to 700 feet; maximum depth of 200 to 250 feet; and maximum width across the top of 250 to 300 feet. On the eastern side of the chasm, the wall is very steep to almost precipitous, while the greatest angle of the slope on the western side is about 50 degrees. The highest point is the summit of the so-called "Chimney rock" which rises pinnaclelike on the eastern side of the chasm (see plate 2) and some 50 or 60 feet higher than the highest portion of the western side of the chasm directly

opposite. In the bottom of the rift and also at the eastern base of the Chimney rock mass there are great accumulations of angular blocks of rock, often 10 to 20 feet across, which have rolled down the steep slopes since the development of the chasm.

The fact that, not many years ago, a forest fire made an almost clean sweep of the vegetation from this portion of the mountain causes the chasm and its immediately surrounding rock masses to be very plainly visible.

THE ROCKS

All the exposed rocks are of Precambric age, the main mass of the mountain consisting of fairly homogeneous, moderately gneissoid, granitic syenite, with Grenville strata resting against the western side. The rift is wholly developed within the Grenville strata, which there have a visible thickness of about 250 feet. These rocks, which are very distinctly stratified in layers from 6 inches to 4 or 5 feet thick, are rusty looking biotite-quartz-feldspar gneisses, greenish-gray pyroxene (coccolite)-feldspar gneisses, and some beds of quartzite.

On the western side of the chasm the rocks strike N 20° E or parallel to the rift and dip 50 degrees westward, this strike and dip being uniform down the whole western face of the mountain. On the eastern side of the chasm the strike and dip are quite different, being N 40° W with greatest dip (at Chimney rock) of 20 degrees toward the northeast.

It is important to note that in spite of such marked differences in strike and dip, the rocks on opposite sides of the rift are of exactly the same character in every respect, and it is certain that they were once parts of a continuous mass.

Prominent joint-planes, mostly approximately at right angles to the bedding planes, are common, so that frequently large joint-blocks loosen and slide down the steep slopes.

The exact character of the Grenville strata immediately beneath the exposed gneisses just described is not known though, as will be explained below, they are quite certainly relatively weaker rocks. That they are probably either limestones or at least limestone (or calcareous) strata interbedded with gneisses is strongly suggested by the fact that Grenville beds very similar to those of Chimney mountain are often directly associated with limestone in the central and southern Adirondacks, such association having been frequently observed by the writer in the vicinity of Indian Lake village and in the valleys between that village and Chimney mountain. At the

W. J. Miller, photo.

Looking northward through the great rift on Chimney mountain, with Chimney rock on the right

W. J. Miller, photo.

View of Chimney rock as seen directly across the rift from the highest point on the western side

bottom of the chasm, where one would expect to get some clew to the character of the underlying strata, the heavy covering of rock debris conceals everything.

CAUSE OF THE RIFT

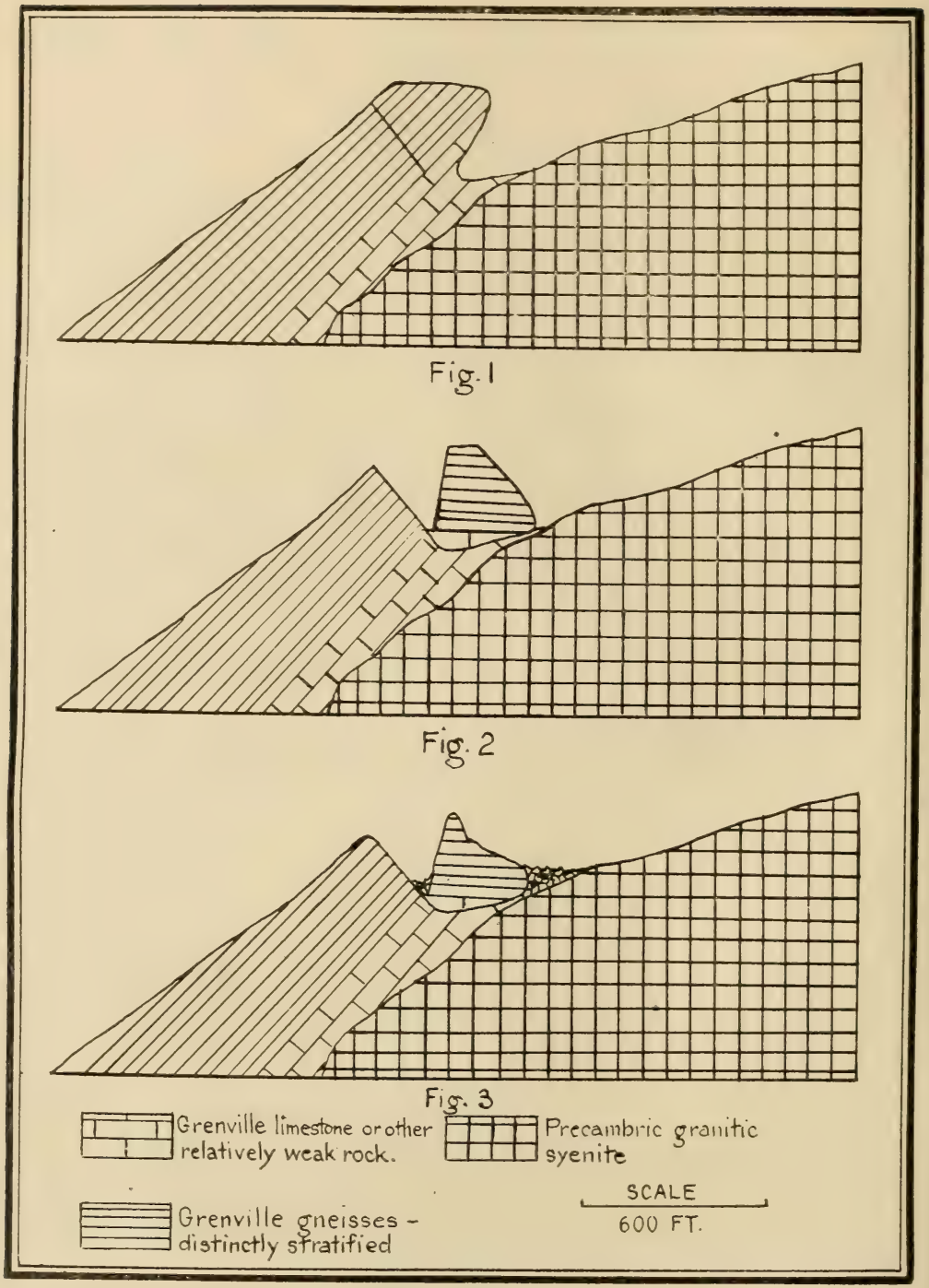
Examination of the accompanying figures will make clear the history of the development of the great rift. The lapping of the Grenville strata against the side of the hard, homogeneous syenite of the mountain mass, with the weaker beds practically in contact with the igneous rock, was decidedly favorable for undermining (figure 1) due to removal of the weaker material by erosion or solution, or both combined, by waters coming down from the higher portion of the mountain during heavy rains or melting snows. Instead of the type of undermining indicated in figure 1 there may have been removal only of certain calcareous layers or possibly a thorough honey-combing of the underlying weaker mass thus greatly weakening the support of the overlying mass.

Finally the undermining proceeded far enough so that a great block of gneiss, already practically separated by a prominent joint-plane from the ledge of the mountain side, was suddenly pulled over by the force of gravity (probably aided by the wedge-work of ice) as shown in figure 2. This great block, from 600 to 700 feet long and from 100 to 250 feet high, swung through an angle of 60 to 70 degrees with greatest subsidence toward the north, thus readily accounting for the marked differences of strike and dip of strata on opposite sides of the rift. It is difficult to conceive how such an undermining process could have been carried far enough unless we postulate relatively weaker or more soluble rock underlying the Grenville gneisses.

That the great block fell no less than 75 to 100 years ago is proved by the fact that trees of considerable size have grown within the chasm, while the large accumulation of talus materials suggests a much longer time than 100 years. On the other hand, the rift is certainly Postglacial as indicated by the utter absence of any evidence of glaciation within it.

As a result of a moderate amount of weathering and the sliding of joint-blocks down the steep slopes, the present-day conditions were reached as shown in figure 3.

The geological principles of undermining etc. here set forth are by no means uncommon, but the development of such a great rift in this manner is somewhat unusual, and it appears to be quite unique in the Adirondack region.



East-west structure sections through the western side of Chimney mountain (looking northward)

Fig. 1 Showing essentially the condition of things not long before the development of the great rift. The position of a prominent joint plane is indicated in the Grenville gneisses.

Fig. 2 Showing essentially the condition of things immediately after the development of the great rift due to breaking away of a large block from the parent ledge of Grenville gneisses.

Fig. 3 Showing the present condition after some weathering and the accumulation of large, angular rock fragments at the bases of the steep slopes.

THE ORISKANY — PIC D'AURORE EPISODE OF THE APPALACHIAN DEVONIC

BY JOHN M. CLARKE

Theme. *In the northeastern Appalachians the Oriskany episode was represented by a heavy deposit of shoal-water sand with the same peculiar fauna that characterizes the sands of this period in the central Appalachian region. This development appears to be restricted wholly to one of the northern channels which follow close upon the line of the River St Lawrence downthrow.*

The Oriskany sedimentation in New York is now understood as the record of a transgressing shelf sea in which the obvious movement of the water was progressively west-northwest. Both in petrology and biology this movement is clear. The shallow waters bounded a continent which lay not far to the north about the interior sea of Appalachia, and were receiving a heavy landwash from subsiding shores; tides and the undertow washed the fine muds far out leaving behind in the shoal waters a clean quartz sand. In New York these sands carry what is historically the typical fauna of the formation, for it was the first to become known and is still to be regarded as the characteristic biota of the "Oriskany." This assembly was largely made up of heavy shells, both of brachiopods and gastropods, and it has been a frequently expressed conception that such ponderous shells as these were a direct response to the demand for more secure protection in the play and pounding of the waves along the strand. There is, however, a well-known and so-called "calcareous Oriskany" in southeastern New York, a region where a larger and much more variant fauna existed and where the sediments are indicative of deeper water because of the presence of lime. These deeper sediments carry a very large silica and clay content, and the condition of the silica is not that of quartz sand nor can it yet be safely regarded as the fine silicious outwash from the shore. The petrology of this silica content has yet to be fully deciphered. Its chert masses and the irregular distribution of the silica matrix indicate secondary change and quite possibly an obscure benthonic fauna not yet known. The very clear distinction between the fauna of the sands and of the limestones is recognized, and it is evident that, in these New York occurrences at least, the heavy species which locally abound in the

sands are rare in the limestones, and when they do occur are quite likely to be of smaller size. The inference from these conditions has been a natural and easy one and is to this effect: that the sand fauna represents the shoreward movement of the fauna of the period and is composed of well-adjusted representatives and survivors of the deeper water. This is a conclusion which is quite reasonably applicable to such conditions, for we must often interpret these near-shore faunas in terms of migration from the outer sea.

In actual succession the sand beds of the Oriskany are a later term than the lime beds of Hudson, Glenerie, Highland Mills, Otisville etc., but this fact does not affect the fauna as such; a readjusted element out of the more prolific deeper water reservoir.

Turning to the expression of this Devonic episode in the northeastern Appalachians, we find a better evidence for the inferences above intimated, for there it is obvious, in the first place, that there is no real "facies" relation between the sandstone fauna and its environment, and it becomes perfectly clear that the sand species of New York must be regarded as only happy readjustments which traveled into shoal waters from the deeper biota, because this association has in full exemplification all the elements of the fauna together, brachiopods and gastropods with their full weight of shell, in the lower or Oriskany horizon of the Grande Grève limestones.

The Grande Grève limestones constitute a series which is faunally comprehensive, for its upper beds carry clear indications of a later than Oriskany fauna, while its lower beds express the Oriskany element; and in its petrology it is a mass of deposits gradually increasing in purity of lime from the bottom up, while the impurity of the lower layers is not silica in the form of sand but a clay-silica matrix. In the higher beds the silica becomes much more obvious and often is segregated into horizontal chert masses, and even where the limestone appears to be pure there is often a large residuum of silica which in spots is practically composed of masses of silicious sponge spicules.

The expression of the Oriskany sedimentation episode in the Grande Grève series of northeastern Gaspé is highly typical and apparently perfectly normal. Here exist, for example, heavy Rhynchonellas, Hipparionyx, Rhipidomella, Chonetes, Spirifer, Rensselaeria and Diaphorostoma, as in the sandy Oriskany of New York, with no diminution of size or weight but in a highly calcareous matrix and in association with species which farther westward represent the earlier facies of the Oriskany in New York.

In this northern Gaspé region the shoal-water sand and the shoal-water fauna as such are apparently quite absent from the series.

I have recently had occasion to describe the Pic d'Aurore section.[1] The Pic d'Aurore is the high, transected vertical mountain face which overhangs Malbay and faces the north shore of Percé on the Gaspé front. The cliff section here is a reasonably long one, extending a distance of about 3 to 4 miles from Cape Barré at Percé to Cannes-des-Roches and thence on to Corner-of-the-Beach. The section from Cape Barré, which is at the Percé end and therefore at the east, three-fourths of the distance to Cannes-des-Roches, is composed wholly of the much contorted pre-Bonaventure rocks, and in the Pic d'Aurore, where the section reaches its maximum height, the rocks of the Lower Devonic are best exposed.

Previous descriptions have made it obvious that the Percé limestone, which constitutes the Percé rock and a part of the sea cliff of Pic d'Aurore, is, on the basis of community of species, continuous with the Grande Grève limestone, but it has not been assumed at any time that the Percé limestone was to be closely paralleled with the Oriskany division of the Grande Grève limestone. The face of the Pic d'Aurore and of the entire line of the cliff wall, known in the community as " Les Murailles," is brilliantly colored, and in the Pic d'Aurore itself much of this color, in the lower and vertical beds, is due to a washing down of color from the horizontal red Bonaventure beds, which form a cap to the summit. The inaccessibility of the cliff face, the masking of essential by secondary structures and the diffused coloration of the section easily confuse the observer so that the interpretation of the succession is not without difficulties. I bring it to notice in this connection because of its demonstration of the fact that in this part of Gaspé the shoal sedimentation of the Oriskany episode was actually highly developed. Here is a fairly close fold of the beds lying beneath the Percé limestone and the order of succession will be intelligible from the diagram facing page 152.

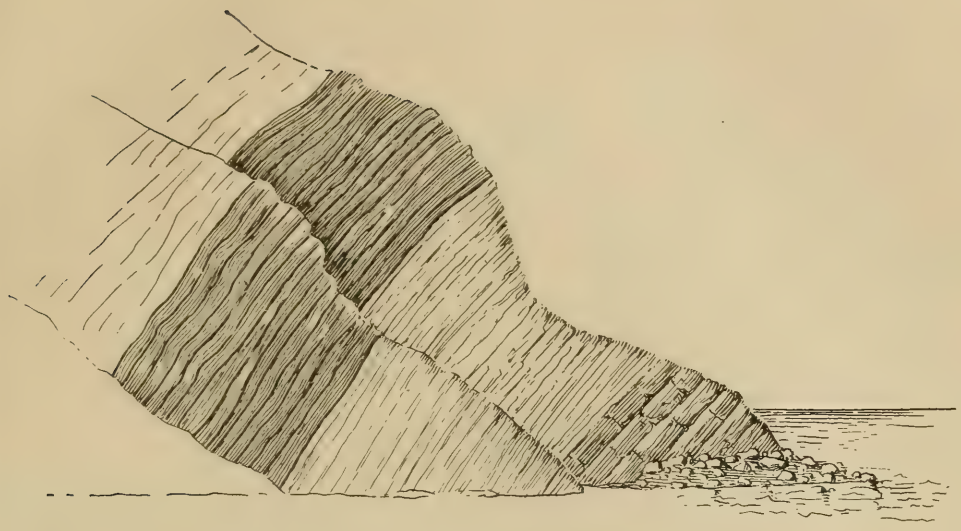
The " Percé limestones " are here underlain by rather thick series of white or greenish-gray sandstones which are essentially devoid of fossils though carrying traces of something like a Cladopora. They are for the most part thin bedded and are not of a sort to promise much in the way of fossil content, though in their lower part, on the west flank of the syncline, they have produced

[1] Geological Society of America, Philadelphia meeting 1914.

Spirifer murchisoni and Rhipidomella musculosa. In the midst of these folded sandstones, however, on the east flank of the anticline, lies a darker sandstone band in which the grains are notably coarse, in places actually pebbles, and here, in bad preservation, occurs the typical sand fauna of the New York Oriskany; that is to say, Rensselaeria ovoides, Leptaena ventricosa, Spirifer arenosus, Leptocoelia flabellites, Hipparionyx proximus, Diaphorostoma ventricosa and a large Pterinea; no other fossils have been observed and none at all that would be regarded as tying this fauna and its formation to the deeper waters or the deeper water fauna.

The Barré limestone at the eastern end of the section is known to contain the trilobite Dicranurus, and this alone is evidence of its very earliest Devonic age, and the horizon is thus, rightly I think, construed as the base of the entire Devonic section. The contact between this and the Percé limestone on this cliff section is a fault, as is very clearly shown. It is probable that the Barré limestone is a term lying beneath the limestones of the Pic d'Aurore fold, in view of the recognizable difference in petrology and the fauna. The *Pic d'Aurore series* is the term now used for this succession of predominant sand sedimentation with intermingled limestone beds, and it may be regarded as extending from the base of the Percé limestone down to the contact line between the sandstones and top of the Barré limestone.

The contact of the Devonic with the earlier beds is an unconformity at the west of this section and both Siluric and Ordovicic strata are exposed at the base of the cliff near the mouth of the couleé which runs down at this point from the face of the Grand Coupé in Percé mountain. On the other side of this couleé the cliff is composed of further development of the corrugated Siluric beds above with Ordovicic beds beneath. From this point the section on to Cannes-des-Roches or the northwest end of the cliffs is represented as composed entirely of the green and mottled marls, red sandstones and dark shales of the Bonaventure conglomerate, all of which have obviously been overturned from the Table-a-rolante and which form only a thin veneer overlying the seaward edges of the Siluric-Ordovicic beds.



The "Oriskany" band (dark lined) in the Pic-d'Aurore formation

This layer is a band of only 2 or 3 feet in thickness, and with the white sandstones above and below, the total thickness of the sand deposition is 100 feet or more. Under the sands in the heart of the anticline comes a blue-gray limestone becoming brown and dolomitic; Leptaena rhomboidalis, a large Palaeoneilo and a coarse meshed Dictyonema have been found, but the beds are specially characterized by the abundance of Haliserites, a Fucus highly characteristic of the early Devonic of western Europe but essentially absent elsewhere from the Appalachian record. Below this horizon are red-yellow platten-limestones with a large element of sand, and these are visible in the section only on the western limb of the syncline. In these beds has been found a very large Homalonotus having a body width of 3 inches, and a large Diaphorostoma. After some 40 feet of these beds follow below 75 feet more of much distorted and corrugated green-gray thin sandstones which bend upward to an almost vertical position.

The succession of this entire series shows a marked diversity on the two flanks of the folds, the true Oriskany fauna with its dark sandstone band at the east not appearing at the west, and the limestones beneath, constituting the part of the decapitated fold, are identifiable on the uprise at the west only as interbedded with the sandstones. This change is probably somewhat exaggerated in the sketch here given, but it is evident that the close folding has squeezed out these limestones in some measure, and, further, that the sandstones which make the lowest term at the west were not caught in the edges of the fold and are thus not represented on the eastern slope.

Explanation of Pic d'Aurore section. This is the cliff section extending from southeast to northwest and facing the Mal-Baie. The attempt has been made to give the strata approximately their natural coloration in the morning sun, though actually the red color of the summit peak is spread downward by the leaching of the rains over the surface of the less brilliantly tinted strata. The height of the Pic d'Aurore is about 800 feet. A part of the village in the north bay of Percé is seen beyond Barré cape. The section cuts the Appalachian folds of the Precarboniferous Paleozoic somewhat obliquely but is almost at right angles to the section on the gulf front at Percé from Cape Barré south.

The mountain in the background is the plateau or relict-mountain, the Table-à-rolante, to whose type of structure reference is made again in the following paper. This relict-mountain is composed of red Bonaventure or post-mid-Devonic-Carbonic and sands and conglomerates lying in low waves dipping toward the north, and its beds rest on the eroded folds of the Paleozoics. A moiety of these horizontal Bonaventure beds makes the summit of the Pic d'Aurore where they lie on a truncated anticline of the Devonic series.

Bonaventure conglomerate. All the northwestern end of this section is constituted of this formation and the strata here slope evenly to the water so that the observer from the present point of view looks against the up-surface of one bed or of closely successive beds. This mass of the Bonaventure has obviously fallen down and over from the horizontal plateau mass above, from which it has been rifted. Sections across this mass at right angles to the shore show it to be a mere veneer leaning against the Siluric-Ordovicic beds. The angle of attitude in these Bonaventure marls and sandstones lessens toward the west, and at the end of the section at Cannes-des-Roches the beds lie again in a horizontal position. The rocks are mostly gray-green and mottled sandy marls, with some sharply outlined beds of red sandstone and conglomerate layers, and the edge of one of these, where the stratum has been broken off and slipped into the sea, is shown at the right. There are also some patchy layers of dark shale.

Next follows in order of succession downward the *Percé limestone,* which here makes the Trois Soeurs or the three cliffs at left of the Pic d'Aurore, and whose closely infolded remnant is seen at the right on the flank of the Pic.

Below is the *Pic d'Aurore series* in characteristic close folds; first, the white sandstone showing in the east flank the dark band with

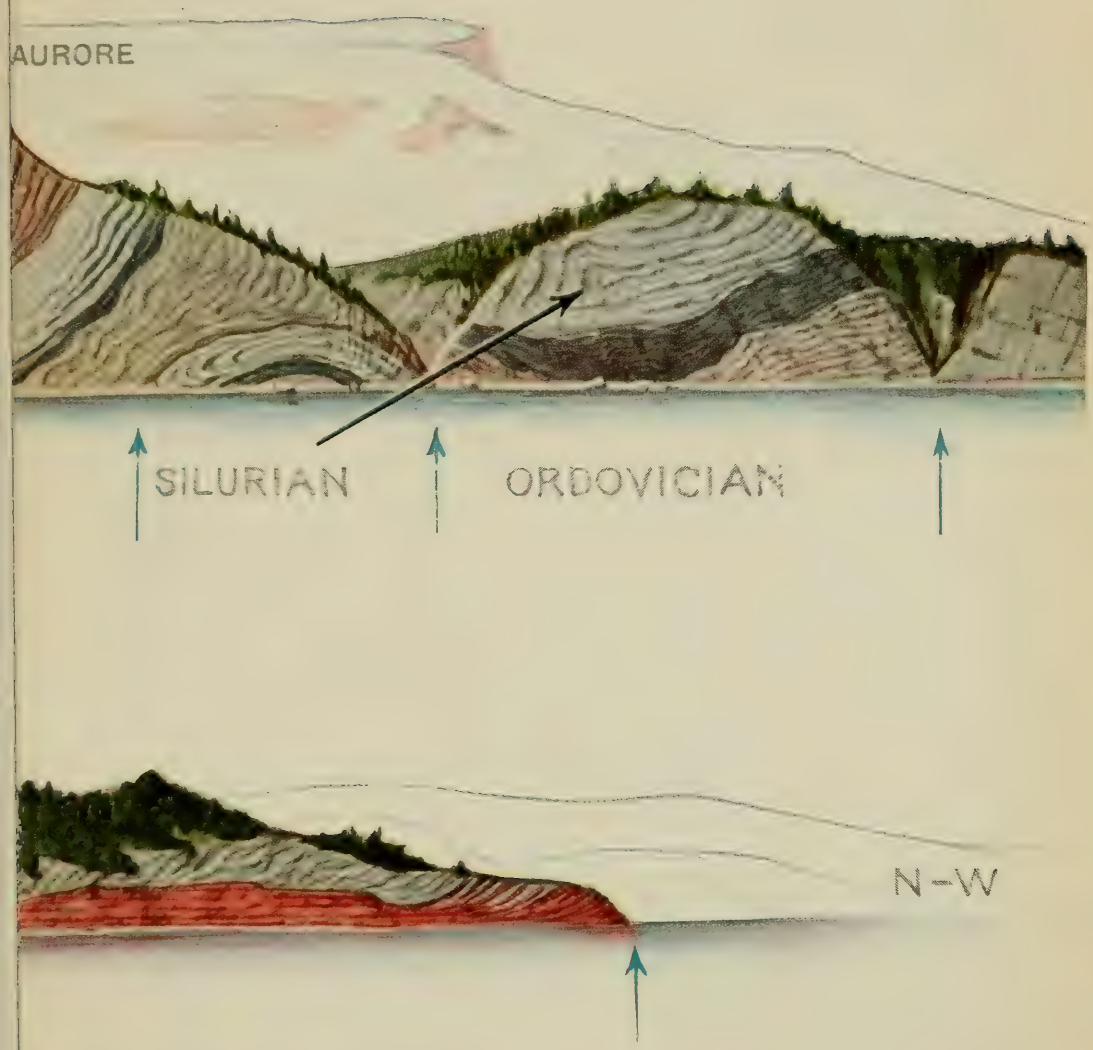
Explanation of Pic d'Aurore section. [illegible] is the cut-section extending from southeast [illegible] and along the Mal Baie. The attempt has been made to give the strata approximately their natural coloration in the [illegible] though actually the red color of the summit peak is [illegible] the bleaching of the rains over the surface of the [illegible] The height of the Pic d'Aurore is [illegible] in the north bay of Percé is [illegible] cuts the Appalachian folds of the Proterozoic [illegible] what obliquely but is almost at right angles to [illegible] gulf front at Percé from Cape Barré south.

The mountain in the background is the plateau or relict-mountain called Table-à-roluate, to whose type of structure reference is made again in the following paper. This relict-mountain is composed of red Bonaventure or post-mid-Devonic-Carbonic shales and sandstones and conglomerates lying in low waves dipping toward the north, and these beds rest on the eroded folds of the [illegible]. A remnant of these horizontal Bonaventure beds caps the summit of the Pic d'Aurore where they lie on a [illegible] of the Proterozoic series.

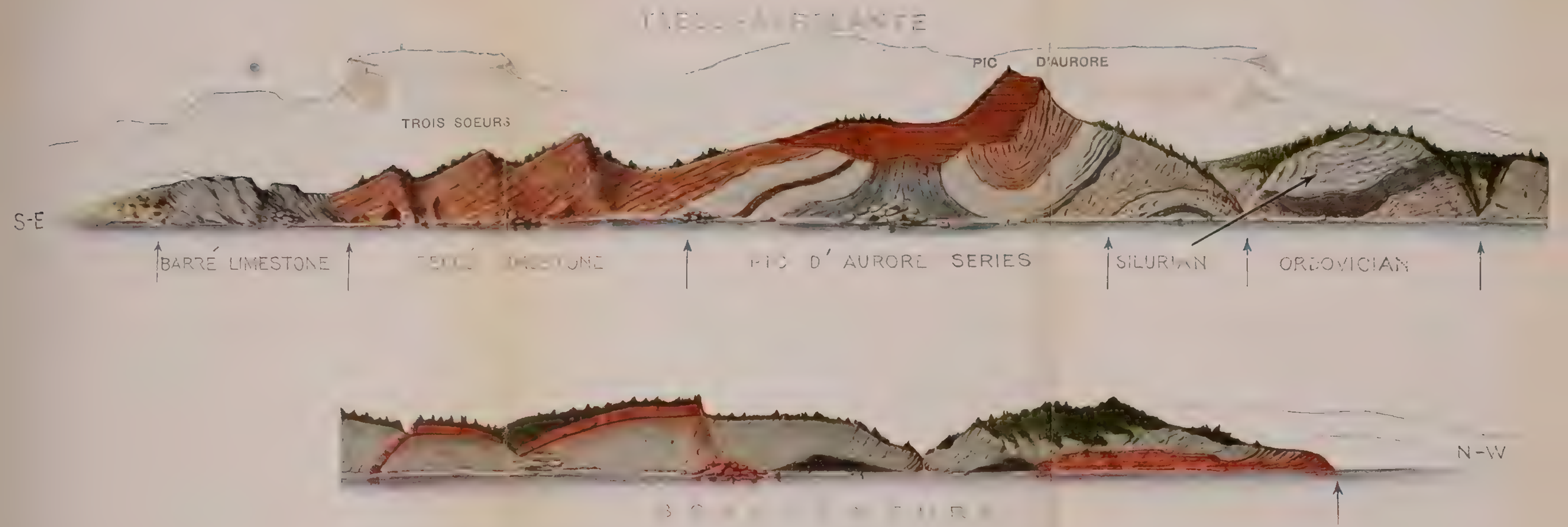
Bonaventure conglomerate. At the northeastern end of this section is constituted of the Bonaventure and the strata here slope [illegible] to the water so that one can walk over from the present point of view [illegible] the [illegible] of nearly successive beds. [illegible] of the Bonaventure has obviously fallen down and over from the [illegible] plateau mass above, from which it has been rifted. [illegible] across this mass at right angles to the shore show it to be a mere veneer leaning against the Siluric Ordovicic beds. The angle of attitude in these Bonaventure [illegible] stones lessens toward the west, and at the [illegible] Cannes-des-Roches the beds lie again [illegible] rocks are mostly gray-green and [illegible] sharply outlined beds of red [illegible] and the edge of one of these, [illegible] off and slipped into the sea [illegible] some patchy layers of dark shale.

Next follows in order of [illegible] the Percé limestones, which here makes the [illegible] of the Pic d'Aurore, and which [illegible] to the right on the flank of the [illegible]

[illegible] is the *Pic d'Aurore* section [illegible] and white sand-stone [illegible]


AURORE
SILURIAN
ORDOVICIAN

N-W



The Pic D'Aurore Section

the normal Oriskany sand fauna, merging beneath into limestone layers which seem to carry a uniform calcareous content through the heart of the fold and, thus, to lack the sandy element which follows in the west flank of the peak. This calcareous sedimentation may be regarded as indicated in the lower beds of the white sand of the west slope where a still lower term is shown in the corrugated vertical and thin-bedded sandstones. For the present the Pic d'Aurore series is constituted of the terms shown in this double fold.

The line of contact between the lower sandstone of this series and the underlying disturbed Siluric is an unconformity and probably the term represented by the Barré limestone shown at the east end of the section is here missing. The Siluric limestones are displayed in this section at the base of the west flank of the Pic and in the upper part of the next cliff face, and also along the walls of the couleé which runs from the shore here back to the mountain above.

Below these much disturbed and blue-gray limestones are gray, thin-bedded limestones, passing into a dark shale with a very characteristic Lorraine fauna.

THE RIFTED RELICT-MOUNTAIN, A TYPE OF "OLD RED" OROGENY

BY JOHN M. CLARKE

Theme. *Mountains of "Catskill" type and age have generally been regarded as plateaus or mesas downcut by rejuvenated drainage. It is probable that their isolation as mesas is due to the rifting of their sides by solution of the underlying pavement, especially where the latter is calcareous.*

The Catskill mountains of New York, an elevated and much dissected plateau of horizontal rocks, are now interpreted as a deposit made largely in the deltas of the streams which were the drainage outflow from mountains at the east whose roots alone are known to us as the hills and ridges of southern New England. This conception of the origin of the Catskills as a continental rather than a marine deposit, formed at the edge of the continent where fresh waters were pouring into the salt, is an old one which has gradually worked itself into general acceptation from data accumulated from many sources and at the hands of many investigators. The additional conception that it is the accumulation of land wash from the degradation of now wasted mountains at the east is one that we owe more explicitly to the recent work of Professor Barrell.

The geological age of the Catskill formation in the Appalachian region as a whole has been quite uniformly regarded as covering the final term of Devonic time, and there has been no conclusive evidence adduced as yet that this terrestrial sedimentation ignored the conventional marine boundaries between the Devonic and the Carbonic. The writer has at one time or another expressed the belief that, so far as the Catskills of New York are concerned, a coordination of deposits of this "Old Red" type would indicate the fact that the Devono-Carbonic marine time boundary line was actually transgressed in this deposition and that the upper part of the original Catskill sedimentation in New York, whether or not any trace of it remains from the subsequent dissection of the Catskill plateau, was deposited in post-Devonic times. This interpretation was suggested in the first place from a study of the so-called "Catskill" deposits of the southern counties of New York west of the general area of maximum Catskill sedimentation and at a time when it became necessary to subtract from what had been

regarded as "Catskill" certain areas obviously of Carbonic age and now designated as such on our geological charts. The formal subtraction of these elements has left certain restricted areas which express, how truly we do not yet know, the presence of Devonic Catskill sedimentation in that region. Study of the so-called "Bonaventure formation" in the northeastern Appalachians, of like composition, color and attitude to the Catskill, has fairly indicated continuous sedimentation through the last term of the Devonic time into the early terms of Carbonic time, and increases the probability that this type of "Old Red" sedimentation in the middle Appalachians also overpassed the Devono-Carbonic boundary line.

To students of geology and topography the attitude of the Catskills in New York has presented an unanswered question. While one may be impressed with the rapid degradation of the Catskill mountains massive and the deep downcutting of the drainage belonging to its successive peneplains, still the most conspicuous and most striking feature of this topography is the abrupt eastern face which fronts the Hudson river. Exposed as this face is throughout its entire length to the great thoroughfare of traffic up and down the Hudson valley, its origin excites constant inquiry and its explanation has never been satisfactorily set forth. While these eastern walls of the Catskills are sheer and their almost horizontal strata stand out bare and conspicuous to the observer, they are nevertheless somewhat rounded off by wear and the approaches to the heart of the mountains from the east not so abrupt as they may seem, yet to everyone who attacks them from this side their abruptness is their most impressive feature.

The question that promptly arises in the thoughtful mind, looking upon this high pile made up of the edges of horizontal strata, is this: What has become of the east and northeast continuation of these horizontal beds which, if continued at the angle at which the beds now lie, would have stretched as a mantle far over the Hudson valley and the western hills of New England?

I am not aware that the geological conditions surrounding these mountains themselves present an immediate solution to this problem, and yet I think the answer is to be found by turning to some other part of this sedimentation chapter where the mode of such mountain building is more lucidly set forth. The Catskills of New York in their eastern portion have been deposited on an area of old rocks which were folded and distorted before this later sedimentation began. Part of the pavement area on which the Catskill sedimenta-

tion rests is of the so-called "Hudson River shale" but other parts, particularly those underlying the mountains where the eastern face reaches its most abrupt expression, are the distorted limestones of the late Siluric and Upper Devonic, the limestones which enter so very largely into the composition of the features which Professor Davis has designated as the "little mountains east of the Catskills" and constitute the broad lowland between them and the Hudson river. In lower Quebec and New Brunswick the equivalent continental deposit known as the "Bonaventure" mantles the coast regions only, lies, like the Catskill, for the most part without distortion on the edges of highly disordered Siluric and Devonic limestones, and its material may have been derived from the northern and northeastern shores of the uplifted continent of Laurentia and its north Atlantic extent, for the fact of this derivation of sediment from the east is evident in the westward thinning of the mantle wherever it is found. Its greatest thickness is, like that of the Catskill, always at the east.

Behind the village of Percé, P. Q., which stands at the outermost front of the Gaspé peninsula, rises a cluster of mountains whose center is composed entirely of this sedimentation of coarse conglomerates and heavy sands. The summit level at this center lies at approximately 1200 to 1400 feet and the summit platform is a gently rolling surface which retains approximately its original form without much degradation and with very little evidence of stream dissection. The long, low rolling summit, sloping off toward the north, impressed the early French settlers and they gave to the place the name *Table-à-rolante,* a term which applied to the whole plateau of the central Percé mountains, the outer and easternmost of which, with its sheer red cliff like that of the Catskills, is today more commonly known as *Mt Ste Anne.* This mass of rocks has in itself no structural features not comparable with the Catskills of New York. They are on the whole more conglomeratic, but the approach of their strata to horizontality, their low, long undulations and their greater thickness at the east, all indicate a similar contemporaneous, if not common, origin.

The *Table-à-rolante* is an uplifted relict of this Devono-Carboniferous Bonaventure formation, bounded by four sheer sides and resting on the upturned Paleozoic limestones. On all except the seaward side these Paleozoics surround the *Table-à-rolante,* rising to greater heights and extending back into the great Paleozoic field of interior Gaspé. The *Table-à-rolante* itself stands like a tremendous cake of pack ice on the waves of the sea, an isolated, almost

quadratic mass of this continental deposit. The bounding walls are so abrupt, and so brilliant as well, as to make an extraordinary type of mountain scenery which is not comparable in its effect to anything known to the writer. To the casual observer this isolated quadratic mass with its high walls is naturally interpreted as a residual block left behind by the faulting away of its lateral parts. I think that this is probably an approximate explanation, but not a final one. The faulting has taken place in the sense that there has been a removal of the outlying portions along approximately vertical planes and probably along corresponding vertical joint faces, but the causes of this removal are, I think, not due to the thrusts generally effective in the process of faulting but to the downsinking of these lateral parts through the removal of the basal calcareous pavement by solution. This fact comes into rather clear evidence on a consideration of the outlying region. This is a part of the tremendous limestone region of Gaspé where practically all the vast Ordovicic and Siluric strata, with a thickness of probably not less than 10,000 feet, and the superjacent calcareous Devonic strata not only reach the coast but run far out to form the coastal shelf. The solution and destruction of this calcareous mass on the sea front is obvious on every hand, particularly in the ragged limestone cliffs and islands which bound the coast.

It is on this open shore, where the sea has cleared away obstructions and long ages of its activity have worked the greatest decay upon the limestone pavement, that the process of the rifting of this Bonaventure plateau becomes most apparent. The sea face of this plateau — Mt Ste Anne — is sheer and in the line of its normal, out into the sea, lie (1) the joint or rift block, called Petite Ste Anne, which has settled down close to the foot of the parent mass and from which it is today separated by a rift only a few rods wide; (2) the Robin reefs whose tops are exposed at low water some 100 rods from the shore; (3) Bonaventure island, 3 miles away, itself a great joint-block with its higher edge to the eastern sea, its lower to the mainland, its surface slope thus from east downward to the west.

It is not to be bluntly stated that this joint-block of Bonaventure island was actually rifted from the face of the residual plateau, as though first in the order of visible remnants, and slipped to its distorted position along the decaying limestone base on which it rests; it is implied that some such process has been in effect; that the Bonaventure block has actually been displaced and dislodged from its original place with just the same degree of certainty as that

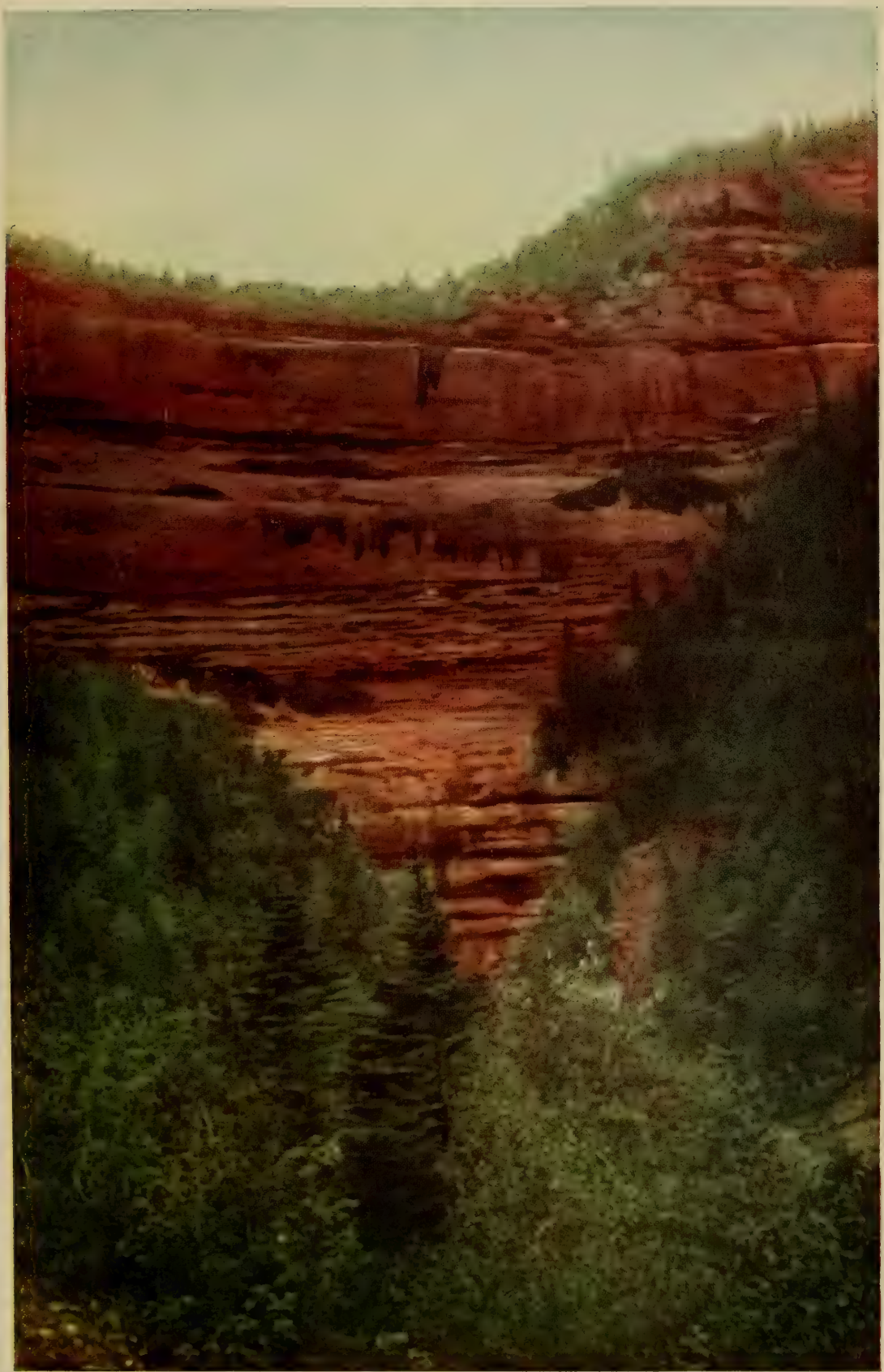


TABLE-À-ROLANTE, PERCÉ

Grande Coupe. Siluric limestones in lower foreground

(By Lillian Douglas Bostock)

TABLE-À-ROLANTE, PERCÉ

Eastern rift-face; the Grande Coupe

(By Lillian Douglas Bostock)

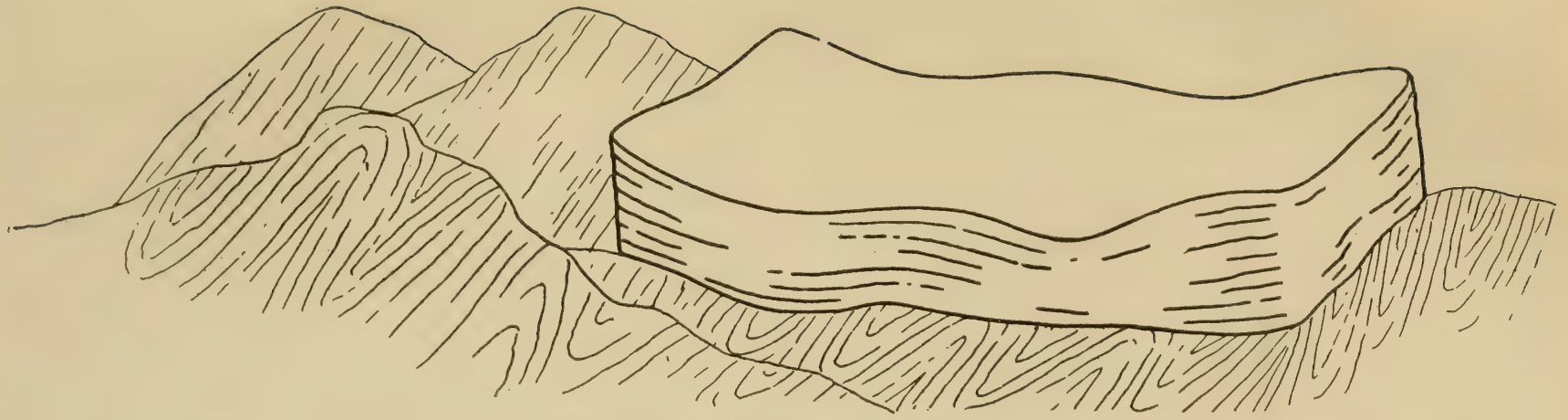
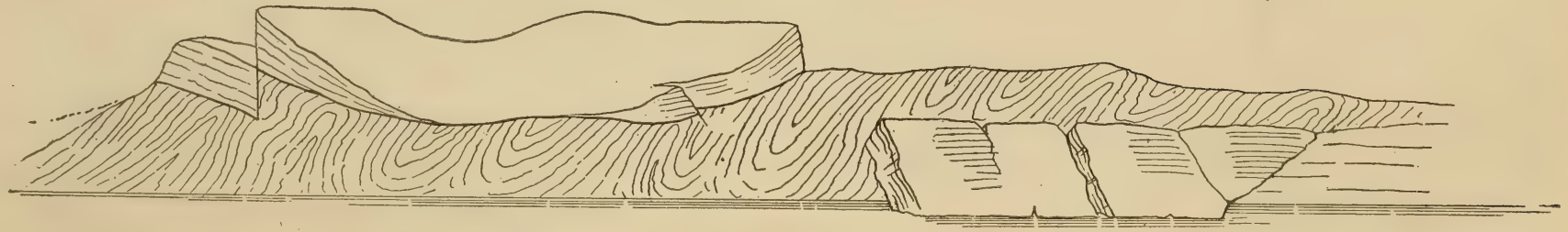


Diagram of the relict-plateau mountain of Bonaventure conglomerate at Percé; from the South



Sketch of the Percé Mountain from the North showing Ste Anne, Petite Ste Anne (rifted) and the downfallen masses of this conglomerate sheet which lie at the water edge against the distorted Paleozoics

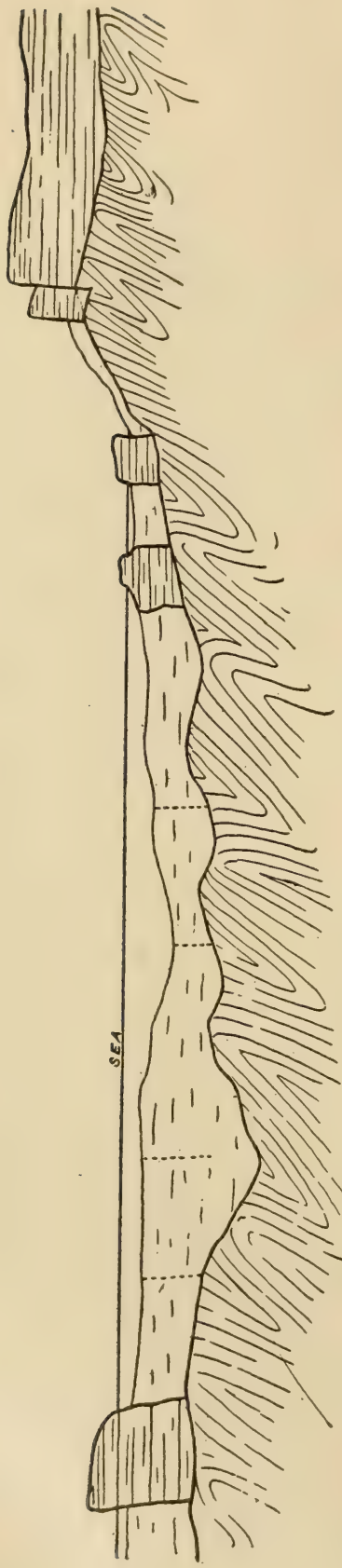


Diagram sketch showing the suggested rifting of the Bonaventure conglomerate. From the right successively Mt Ste Anne, Petite Ste Anne, Robin reefs, Bonaventure island.

it was once a part of the shoreward mantle. The rifting away of the ragged block now making the Robin reefs, from the mass of the *Table-à-rolante,* is a more proximate conclusion. Here on the sea front the remnants of these torn-off blocks are more beneath the eye than elsewhere at the sides of the *Table-à-rolante* platform, but these other sides are not without their evidences of downthrow blocks. One sees them on the north at the foot of the Grande Coupé and the shore of Malbay from Grande Coupé to Cannes-des-Roches and to Corner-of-the-Beach is an overturned mass of Bonaventure tipped down over a basement of Ordovicic-Siluric limestones.

Such rifting as this, resulting from a solution of the basement, has naturally been effective wherever Old Red deposition was left on a limestone base — and these conditions hold true for the northeastern face of the Catskills. Here the relicts of the process bear the marks of great antiquity in notable contrast to those in the northeast. The scarp surfaces of the Catskills are rounded, sloped and deeply eroded, in the Percé mountains they are sharp and fresh; but there is throughout the mountains of Gaspé and their relations to the sea an aspect of newness which constantly surprises the observer. That, however, the rifted Old Red mountains of the

far northeast and of the eastern slopes of the Catskills have been constructed on the same principle and are due to like causes, there seems every reason to believe.

SOME FUNDAMENTAL TYPES OF HYDROSPIRES WITH NOTES ON POROCRINUS SMITHI GRANT

BY GEORGE H. HUDSON

In many of the limestone beds of Valcour island, deposited under lagoon conditions on the lee side of reefs and containing much fine, silicious or argillaceous material derived from land wash or atmosphere, we find an abundance of echinoderm plates so well preserved as to show minute details of form and structure. This material is so abundant and so varied in nature as to throw much light on the paleobiology of the group in question and the value of this material is enhanced by the fact that it represents a time so near the beginning of available life records. It is the purpose of this paper to point out four fundamental types of hydrospires, three of which are shown in the Valcour island material. As one of these types is identical with that presented by Porocrinus, and as this peculiar type seems to be little known, we shall here use P o r o c r i n u s s m i t h i to exemplify it.

In plate 1 we present two hydrospire areas enlarged to 10 diameters and photographed without gum mounting, as this gives us the more brilliant surface detail. In plate 2 we show a single hydrospire area under gum and enlarged to 20 diameters. Billings in Canadian Organic Remains, Decade IV, page 34, called these exposed hydrospire areas "pectinated rhombs," but the ontogeny and position of the folds will show that they differ fundamentally from a true pectinirhomb. In the latter the hydrospire is confined to the margin of *two* plates, the folds are perpendicular to these margins, the *youngest* folds lie nearest the plate corners and these corners are left fairly strong with plate stereom and so fitted to prevent undue pressure on the sutural ends of the hydrospire folds. Hydrospires of this type occur in the Caryocrinidae and Callocystidae. They are variously protected, being sometimes covered at the suture as in Callocystis or more completely covered as in Caryocrinus. In Porocrinus each hydrospire is situated at the junction of *three* plate corners, the folds meet the sutures at an acute angle (for they are parallel with radii running to plate corners), the oldest folds lie nearest these corners and pressure on their elongated and therefore weakened walls is prevented by a heavy epithecal bar of stereom which crosses and strengthens the middle portion of

each suture. To apply the term rhomb to the triangular hydrospire so formed is somewhat of a misnomer but the more serious error lies in using the same term for types of structures so different in their ontogeny.

In "Paleozoic Fossils," volume II, part I, page 96, Billings proposed the term hydrospires for all specialized respiratory areas in echinoderms and on page 99 made the term include even the epithecal respiratory areas of Paleocystis, for he called these "external hydrospires.[1]" It would be conducive of clear thinking, however, if we could limit the use of the term "hydrospires" to specialized folds of the outer body wall which became subthecal in position, for if we may speak of the epithecal papulae of Palaeocystis or of Palaeocrinus as "hydrospires" we might with equal propriety use the same term for the papulae of asteroids.

Restricting then the term hydrospires as suggested we still need special names for special forms, as witness the term "multidisjunct pectinirhombs," but such terms should be coined to express true ontogenic differences rather than to denote an external similarity in appearance due to convergence in development. For example, the "triangular pectinirhombs" of Porocrinus might be called *gonihydrospires,* but as in all types of echinoderm respiration water is the medium through which oxygen is received, we might shorten the term, without loss, to *goniospires.* This name would be appropriate not only because of the position of these hydrospires at plate corners, but also because the folds themselves are bent abruptly through an angle of about 60 degrees as they cross the sutures. Hydrospires of the Glyptocystis or Pleurocystis type, from their position on plate sides or margins, could be called *craspedospires.* These two types are alike in that their function is purely respiratory and their position between regular thecal plates.

The hydrospires of Blastoidocrinus and the Eublastoidea are of a very different type, for these are "between thecal plates associated with food grooves" (see N. Y. State Museum bulletin 149, page 198) and they perform the additional function of draining away the surplus water drawn in through the process of food getting. These are *flowing hydrospires,* and the water is changed in them not simply by means of ciliary motion in their external folds,

[1] This pioneer work of Billings I had not seen before the publication of my 1911 paper dealing particularly with respiration in the genera Blastoidocrinus, Palaeocrinus and Palaeocystis: "Studies of Some Early Siluric Pelmatozoa" in N. Y. State Museum Bulletin 149.

but it is forced through them as a strongly flowing current having a fixed direction and due to the ciliary activity of the brachioles. These flowing hydrospires probably function in reproduction and in Blastoidocrinus they carry away all egesta from the alimentary canal. In Asteroblastus (probably) and in the Eublastoidea, this flow is upward (orad) and parallel with two of the deltoid margins. This type may be known as *anaspires*. In the Parablastoidea (N. Y. State Museum Bulletin 107, page 119) the hydrospire structure is of a fundamentally different character and the flow is downwards (aborad) and across the large interradial plate commonly called the deltoid, but probably not a true deltoid in its origin. This distinct type as shown in Blastoidocrinus may be known as *cataspires*.

The term pectinirhomb might still be used for all *epithecal* rhombs, due to forking and partial covering of papulae as in Palaeocystis and Palaeocrinus, but in no case should it be used to denote any form of true hydrospires as here limited. The term pore-rhomb could also be used if applied strictly to covered craspedospires of the Caryocrinus type.

The author has suggested the new terms in the belief that their use will help rather than hinder the development of paleobiology. They emphasize some very marked differences in the ontogeny of respiratory structures and of themselves arouse a suspicion that neither the Protoblastoidea nor the Rhombifera of Lancaster's "A Treatise on Zoology," part 3, are natural orders. In the latter group, for instance, we find forms with epispires of the Palaeocystis and Palaeocrinus type together with forms having the fundamentally different *endospires* of the Glyptocystis type, and this largely because normal extension of the respiratory tracts led both to occupy rhombic areas.

In suggesting this terminology the writer has not been so radical as he would like to be. There seems to be no valid reason why the path of young students should not be made easier by using a name like the Greek *pneumon* for a final term and let our compounds express not only some characteristic of structure or position but the function as well. We already use common terms for alimentary structures although dealing with different phyla of the animal kingdom. Why obscure or banish the thought of function by the use of such terms as pore-rhombs or pectinirhombs? A portion of the table given in New York State Museum Bulletin 149, page 198, is here given to show proper place of terms proposed.

- Invagination of body wall (Endospires)
  - between regular thecal plates (Simple hydrospires)
    - at corners — Goniospires
    - at plate margins — Craspedospires
    - Subtypes variously protected.
  - between thecal plates associated with food grooves (Flowing hydrospires)
    - flowing orad — Anaspires
    - flowing aborad — Cataspires
- Evagination of body wall (Exospires)
  - Papulae
    - forking and epithecal "Pectinirhombs" or epispires.
    - simple as in Cliocrinus.
  - Podia

None of the more complex types of this chart exist today, while simple exospires in the form of papulae are abundant. The forms with endospires developed in regions of remarkably clear waters, that is, waters free from lutaceous material derived from land surfaces or from volcanic ash. The simple hydrospires no doubt possessed ciliated fold-surfaces, but while simple reef muds (Hydrocalcilutites) could be easily removed from their folds by solution, any marked amounts of silicious sediments in the water would be likely to obstruct such folds and kill the organisms possessing them. Paths of melting icebergs and areas off river mouths would be likely to interfere with distribution. Changing conditions, such as the presence of a glacial period, would then lead to extinction of species over large areas. Among endospires, the flowing type was the most successful and anaspires persisted until Permian times. Forms retaining the simple or unspecialized types of exospires best survived the trials besetting them in past ages and gradually became the dominant types of today.

Plate 1

Porocrinus smithi Grant

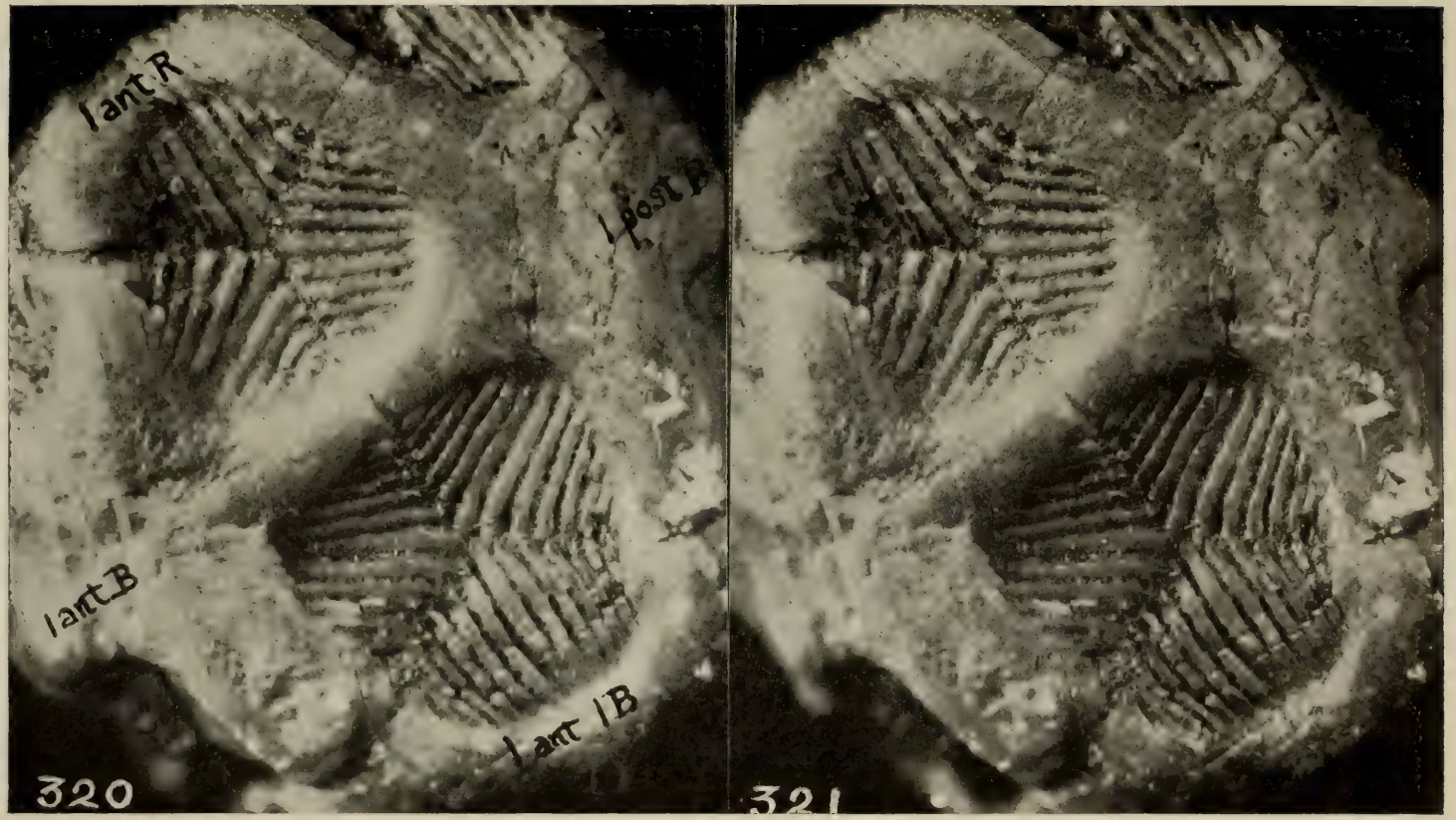
Ottawa Naturalist, vol. 1, trans. 2, p. 42, pl. 3, figs. 1–8, 1881

Chazy limestone, Ottawa Can. Victoria Memorial Museum No. 1422c.

Detail of cotype c x 10 dia., without gum mounting

The white spots on 1 post. B are the remains of the museum number which treatment with gumdamar and benzol had partly removed. Note the rounded or cylindrically convex outer surfaces of the hydrospire folds save on the injured portions of the folds of the 1B.

Plate 1



To be viewed through a stereoscope

Plate 2

Porocrinus smithi Grant

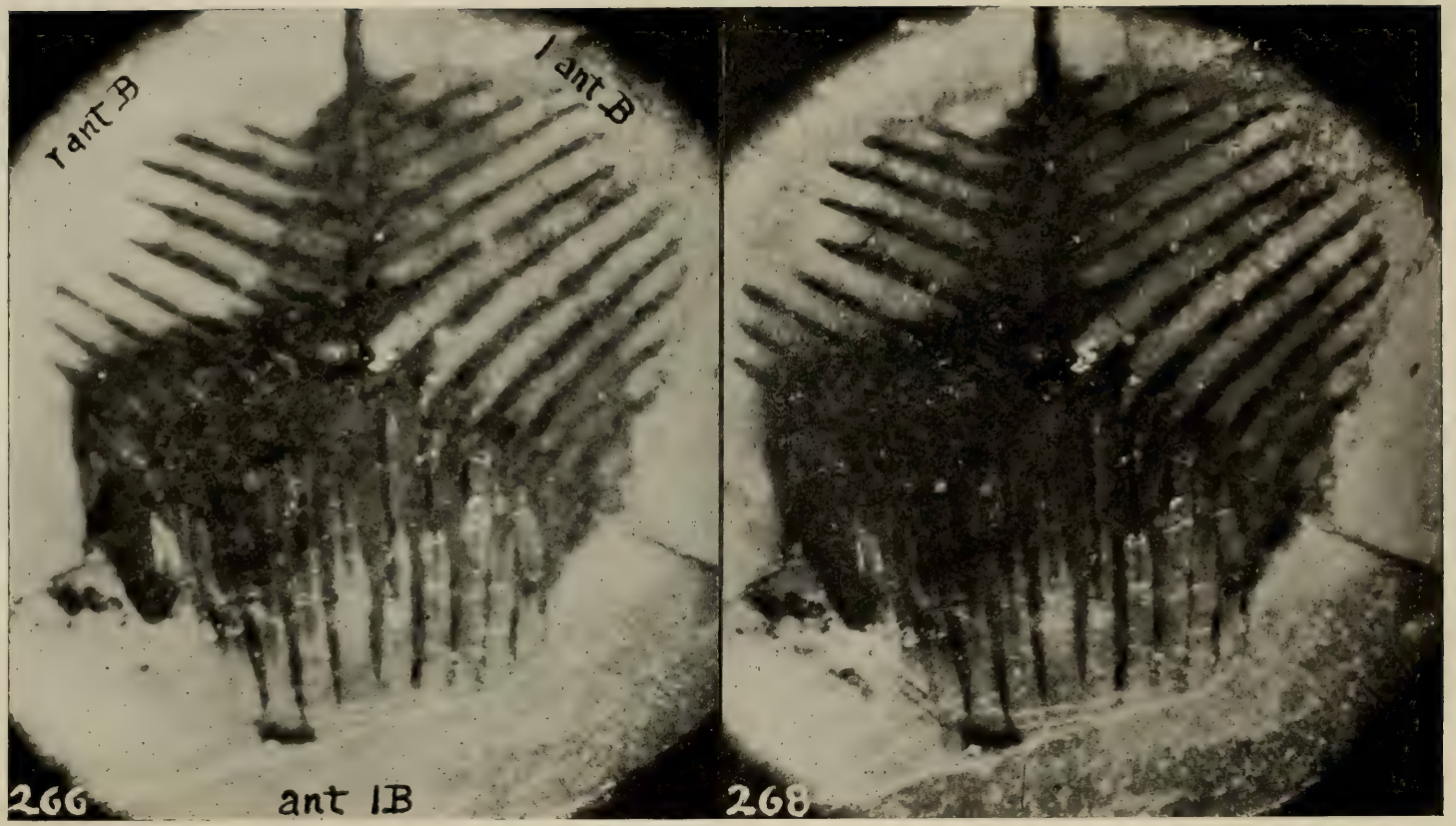
Detail of cotype c x 20 dia., with gum mounting

The *surface* here is not so brilliantly reproduced but the *penetration of light,* due to the gum mounting, is very manifest.

In the hydrospire area here exposed it will be seen that the externally open spaces between the folds (those open to sea water) have been subsequently filled with sediment from the outside, while the broken outer edges of many of these folds reveal the internally open spaces (those formerly occupied by coelomic fluid) as narrow chambers free from sediment.

In the development of goniospires the first invaginated sacs on each suture were made very close to the plate corners and the secondary sacs were formed just *outside* the area occupied by the three primary sacs and not *inside* this area as in the development of craspedospires. This changed position of formation of the secondary and subsequently formed invaginations determined the direction of elongation of these sacs during plate growth and also the form and position of this type of hydrospires. During growth the plate was strengthened by the spreading and thickening of the epistereom over the plate center and along the bar crossing the middle of each suture. This spreading epistereom formed and maintained linear series of small pores, about 0.1 mm in diameter, lying over and communicating with the external chambers in the covered and older portions of the hydrospires. These pores show beautifully in cotype "1422a," when mounted under gum.

Plate 2



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New York State Museum

JOHN M. CLARKE, Director

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These reports are made up of the reports of the Director, Geologist, Paleontologist, Botanist and Entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Director's annual reports 1904–date.

1904. 138p. 20c.
1905. 102p. 23pl. 30c.
1906. 186p. 41pl. 25c.
1907. 212p. 63pl. *Not available.*
1908. 234p. 39pl. map. *Not available.*
1909. 230p. 41pl. 2 maps, 4 charts. *Out of print*
1910. 280p. il. 42pl. 50c.
1911. 218p. 49pl. 50c.
1912. 214p. 50pl. *Not available.*
1913. 158p. il. 29pl. 40c.

These reports cover the reports of the State Geologist and of the State Paleontologist. Bound also with the museum reports of which they form a part.

Geologist's annual reports 1881–date. Rep'ts 1, 3–13, 17–date, 8vo; 2, 14–16, 4to.

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899–1903. The two departments were reunited in 1904, and are now reported in the Director's report.

The annual reports of the original Natural History Survey, 1837–41, are out of print.

Reports 1–4, 1881–84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and ollowing museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

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14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	.45
16	1	20	.50	[*See* Director's annual reports]	

Paleontologist's annual reports 1899–date.

See first note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with the Director's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882–date.

Reports 3–20 bound also with museum reports 40–46, 48–58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4, 17 are out of print, other reports with prices are:

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2	.30	12	.25	22 (" 110)	.25
5	.25	13	*Out of print*	23 (" 124)	.75
6	.15	14 (Bul. 23)	.20	24 (" 134)	.35
7	.20	15 (" 31)	.15	25 (" 141)	.35
8	.25	16 (" 36)	.25	26 (" 147)	.35
9	.25	18 (" 64)	.20	27 (" 155)	.40
10	.35	19 (" 67)	.15	28 (" 165)	.40
		20 (" 97)	.40	29 (" 175)	.45

Reports 2, 8–12 may also be obtained bound in cloth at 25c each in addition to the price given above.

Botanist's annual reports 1867–date.

Bound also with museum reports 21–date of which they form a part; the first Botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports for 1871–74, 1876, 1888–98 are out of print. Report for 1899 may be had for 20c; 1900 for 50c. Since 1901 these reports have been issued as bulletins.

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), in volume 4 of the 56th (1902), in volume 2 of the 57th (1903), in volume 4 of the 58th (1904), in volume 2 of the 59th (1905), in volume 1 of the 60th (1906), in volume 2 of the 61st (1907), 62d (1908), 63d (1909), 64th (1910), 65th (1911) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum Memoir 4.

Museum bulletins 1887–date. 8vo. *To advance subscribers, $2 a year, or $1 a year for division (1) geology, economic geology, paleontology, mineralogy; 50c each for division (2) general zoology, archeology, miscellaneous, (3) botany, (4) entomology.*

Bulletins are grouped in the list on the following pages according to divisions. The divisions to which bulletins belong are as follows:

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3 Economic Geology
4 Mineralogy
5 Entomology
6 "
7 Economic Geology
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10 Economic Geology
11 "
12 "
13 Entomology
14 Geology
15 Economic Geology
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19 Merrill, F. J. H. Guide to the Study of the Geological Collections of the New York State Museum. 164p. 119pl. map. Nov. 1898. *Out of print.*

21 Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sept. 1898. Free.

34 Cumings, E. R. Lower Silurian System of Eastern Montgomery County; Prosser, C. S. Notes on the Stratigraphy of Mohawk Valley and Saratoga County, N. Y. 74p. 14pl. map. May 1900. *Not available.*

39 Clarke, J. M.; Simpson, G. B. & Loomis, F. B. Paleontologic Papers 1. 72p. il. 16pl. Oct. 1900. 15c.

Contents: Clarke, J. M. A Remarkable Occurrence of Orthoceras in the Oneonta Beds of the Chenango Valley, N. Y.
—— Paropsonema cryptophya; a Peculiar Echinoderm from the Intumescens-zone (Portage Beds) of Western New York.
—— Dictyonine Hexactinellid Sponges from the Upper Devonic of New York.
—— The Water Biscuit of Squaw Island, Canandaigua Lake, N. Y.
Simpson, G. B. Preliminary Descriptions of New Genera of Paleozoic Rugose Corals.
Loomis, F. B. Siluric Fungi from Western New York.

42 Ruedemann, Rudolf. Hudson River Beds near Albany and their Taxonomic Equivalents. 116p. 2pl. map. Apr. 1901. 25c.

45 Grabau, A. W. Geology and Paleontology of Niagara Falls and Vicinity. 286p. il. 18pl. map. Apr. 1901. 65c; *cloth*, 90c.

48 Woodworth, J. B. Pleistocene Geology of Nassau County and Borough of Queens. 58p. il. 8pl. map. Dec. 1901. *Not available.*

49 Ruedemann, Rudolf; Clarke, J. M. & Wood, Elvira. Paleontologic Papers 2. 240p. 13pl. Dec. 1901. *Out of print.*

Contents: Ruedemann, Rudolf. Trenton Conglomerate of Rysedorph Hill.
Clarke, J. M. Limestones of Central and Western New York Interbedded with Bituminous Shales of the Marcellus Stage.
Wood, Elvira. Marcellus Limestones of Lancaster, Erie Co., N. Y.
Clarke, J. M. New Agelacrinites.
—— Value of Amnigenia as an Indicator of Fresh-water Deposits during the Devonic of New York, Ireland and the Rhineland.

52 Clarke, J. M. Report of the State Paleontologist 1901. 280p. il. 10pl. map, 1 tab. July 1902. 40c.

56 Merrill, F. J. H. Description of the State Geologic Map of 1901. 42p. 2 maps, tab. Nov. 1902. Free.
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